SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY

SILVERLINER II OPERATOR MANUAL

Prepared by

MORRISON KNUDSEN CORPORATION
RAIL SYSTEMS GROUP
TECHNICAL PUBLICATIONS AND TRAINING

HORNELL, NEW YORK

SILVERLINER II - OPERATOR MANUAL

FORWARD

This Operator Manual has been prepared for use by Southeastern Pennsylvania Transportation Authority (SEPTA) operating personnel on the Silverliner II Commuter Railcars built by the Budd Company and refurbished by Morrison Knudsen Corporation for service on the SEPTA system. The objective for this manual is to provide coverage of operating and equipment data that reflects the actual configuration of the overhauled vehicles. This manual is intended to provide information regarding car or train operation, actual SEPTA operating procedures, and basic troubleshooting. It is to familiarize SEPTA personnel with the controls, indicators, and equipment necessary for proper operation of a single car or consist.

This handbook covers refurbished Silverliner II railcars numbered 201-219, 251-269, and 9001-9017. It is complemented by a Silverliner II Troubleshooting Manual and a Silverliner II Heavy Repair Manual.

All information, illustrations, and specifications supplied are based on the latest overhaul and original equipment data available at the time of publication and through on-car observation and experimentation. If there is a conflict between instructions contained herein and current railroad operating procedures, the latter shall take precedence.

SCOPE

The instructions in this manual apply to single railcar or multi-car consist operation. Section 1 provides general information and contains diagrams of interior and exterior equipment arrangements. Section 2 details locations and gives brief functional descriptions of controls, switches, and indicators needed by enginemen and conductors to achieve car or train operation. Section 3 provides instructions and outlines procedures to be performed by operating personnel in preparing for service, actual operation, lay-over activities, coupling and uncoupling, and operating subsystems activation and deactivation. Section 4 describes the operating subsystems on the cars to provide a better understanding of the operating capabilities. Section 5 defines troubleshooting procedures and presents, in a tabulated form, electrical and braking difficulties, with suggested corrective actions for operating a car or train

in the event of specific equipment failures. Section 6 describes the function and location of miscellaneous equipment carried on a car and provides procedures for coupling to a locomotive.

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LIST OF ABBREVIATIONS

AC	Alternating Current
BP	Brake Pipe
DC	Direct Current
ER	Equalizing Reservoir
HVAC	Heating, Ventilating & Air Conditioning
MR	Main Reservoir
MU	Multiple Units
psig	Pressure in Pounds Per Square Inch as Indicated on a Gauge
RPM	Revolutions Per Minute
VAC	Volts, Alternating Current
VDC	Volts, Direct Current

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SECTION 1
GENERAL INFORMATION

1-1.00 DESCRIPTION

1-1.01 INTRODUCTION

The **"SILVERLINER II"** Commuter Railcars, as built by Budd Corporation, and remanufactured by Morrison Knudsen Corporation, Rail Systems Division, are self-propelled, multiple unit (MU) passenger cars designed for train consist service operation and control on the Southeastern Pennsylvania Transportation Authority (SEPTA) System.

1-1.02 ACCESS TO CAR INTERIOR

VESTIBULE DOORS

Manually operated vestibule doors, four (4) per car, two (2) per side, swing inward to provide access to the vestibules, at both ends of each car.

VESTIBULE TRAPS

After opening the vestibule door, a steel trap is visible at floor-level. If the car floor is level with a surface (such as a high platform), the trap must remain lowered, covering the step-well, when passing through the vestibule doors. If the car is positioned at low level platforms, the trap must be raised to access the steps.

Note: The trap cannot be raised unless the vestibule door is opened and locked.

To raise the trap (Figure 1-1):

Depress the vertical release pin located on the floor approximately one and one-half (1-1/2) feet from the side of the car to release the trap. The trap is equipped with spring-loaded hinges, which will raise the trap toward the opened vestibule door. When fully raised, the trap must be secured with the spring-loaded latch on the opened vestibule door.

WARNING:

STAND CLEAR OF THE TRAP AFTER DEPRESSING THE RELEASE PIN.

Note: When the control door is in the open and latched position (so that it is covering the Engineman's controls), depressing the foot latch, located at the bottom/center of the control door, will release the trap in the same manner as described above.

To lower the trap (Figure 1-1):

1. Pull outward on the latch located on the side vestibule door at the "top" of the trap.

WARNING:

BEFORE RELEASING LATCH ON THE VESTIBULE DOOR, BE CERTAIN THAT FEET ARE CLEAR OF THE STEPWELL.

2. After releasing this latch, use the trap door to pull the trap down.

WARNING:

A FIRM HOLD ON THE TRAP GRAB IRON MUST BE MAINTAINED WHEN LOWERING THE TRAP. THE SPRING-LOADED FEATURE OF THE TRAP WILL OFFER RESISTANCE AS THE TRAP IS LOWERED.

3. Push down on the trap door until it is secured by the vertical release pin at the vestibule floor.

ENGINEMAN'S SEAT

The Engineman's seat is located in each operating cab at the vestibule partition wall (Figure 1-2). When not in use, the Engineman's seat may be concealed by grasping the rear of the seat and pulling upward, swinging the seat into the wall, until secured by the latch.

WARNING:

ENSURE THAT SEAT IS LATCHED PROPERLY BEFORE USE.

To open VESTIBULE DOORS from the outside of the car:

1. Rotate the flip-over handle (located halfway down the door frame) upward so that it is clear of the door.

2. Grasp the door handle (located on the door adjacent to the flip-over handle) and swing the door inward towards the center of the car until it latches.

Note: If the Engineman's seat is down, open the door opposite the Engineman's side of the car.

To open VESTIBULE DOORS from the inside of the car (Figure 1-1):

1. Fold Engineman's seat into its concealed position, if necessary.

2. Rotate the flip-over handle (located halfway down the door frame) upward so that it is clear of the door.

3. Using the T handle mounted on the door, pull inward toward the center of the car until the door is secured by the latches on the vestibule partition wall.

CONTROL/END DOORS

Manually operated Control/End Doors, (located at each car end) are used for train evacuation and to allow access between cars of a multi-car consist. Control/End Doors are closed at the front of front car and rear of rear car.

To operate CONTROL/END DOORS:

1. If necessary, lower traps and fold Engineman's seat into the concealed position as described above.

2. Face the door and unlatch the two flip-over latches found on the left-hand side of the door frame.

3. Pull the door open with the handle (mounted

on the left-hand side of the door) and swing the door around to your right (covering Engineman's controls) until the Control/End Door is held in the opened position by the latch below the brake valve.

CARBODY DOORS AND AUTOMATIC DOOR RELEASE

Carbody Doors provide access to the passenger compartment and are spring-loaded to remain closed when the car is in motion. When the car has made a scheduled stop, Carbody Doors are manually opened and latched by the automatic door release latching mechanism. When the car is set in motion, door latch coils are energized to open the latches, causing the Carbody Doors to swing closed.

To Open CARBODY DOORS:

1. Turn the door knob and swing the door inward toward the center of the car until it mechanically latches onto the automatic door release mechanism.

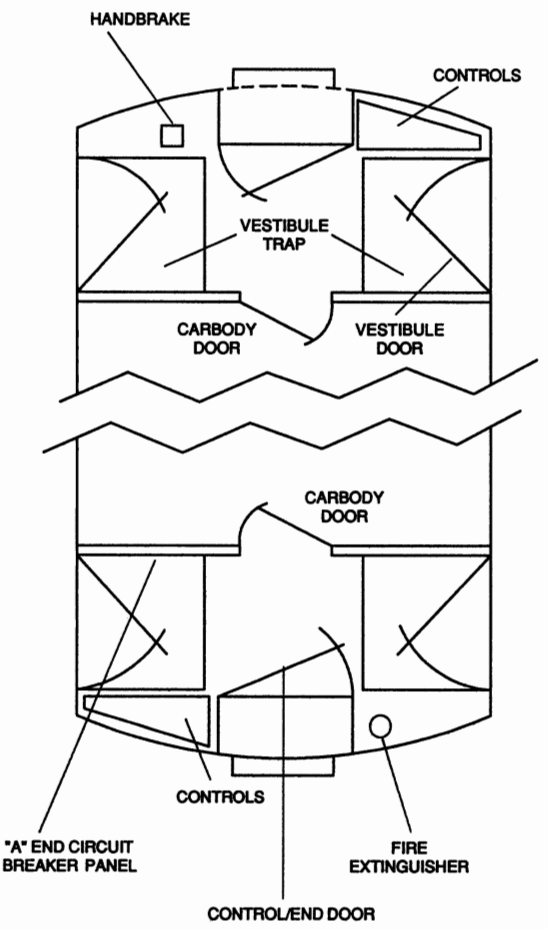


Figure 1-1: Vestibule General Arrangement
Operating Cab, Interior Layout

1-1.03 CAR ORIENTATION (Figures 1-3, 1-4, 1-5, & 1-6)

Car Orientation Data is provided to identify the location of components that require attention when reporting defects.

1. The ends and sides of cars are defined as:

a. The "A" END of a car is the pantograph end.

b. The "B" END has the handbrake in its vestibule. The letter "F" is permanently attached to "B" END of car, designating the FRONT of vehicle.

c. Standing in the "B" END vestibule, facing the "A" END, EVEN Side is to the left and ODD Side is to the right.

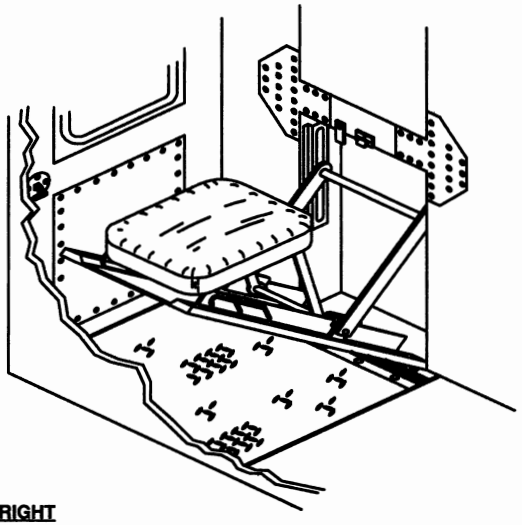
2. Wheels, journal boxes, and parts contained within the truck assemblies are designated as follows (Figures 1-4):

Standing in the "B" END vestibule, facing the "A" END, these components are numbered consecutively, starting at the "B" END:

No. 1 on the ODD Side;
No. 2 on the EVEN Side;
No. 3 on the ODD Side;
No. 4 on the EVEN Side;
No. 5 on the ODD Side;
No. 6 on the EVEN Side;
No. 7 on the ODD Side; and
No. 8 on the EVEN Side.

3. Side vestibule doors are numbered (Figures 1-3 & 1-4):

No. 1 - ODD Side, "B" END;
No. 2 - EVEN Side, "B" END;
No. 3 - ODD Side, "A" END; and
No. 4 - EVEN Side, "A" END.



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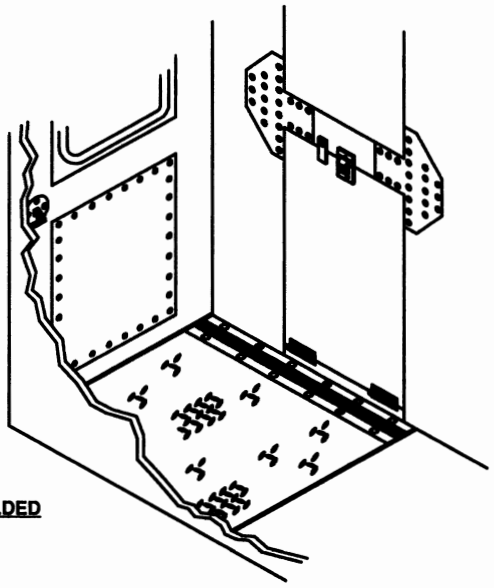

FOLDED

Figure 1-2: Engineman's Seat
Folded & Upright Positions

WARNING:

ENSURE THAT SEAT IS LATCHED PROPERLY BEFORE USE.

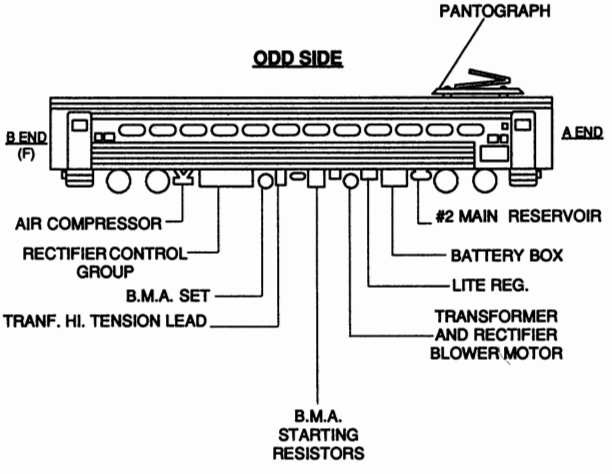

Figure 1-3: Car General Arrangement
Exterior Layout, ODD Side

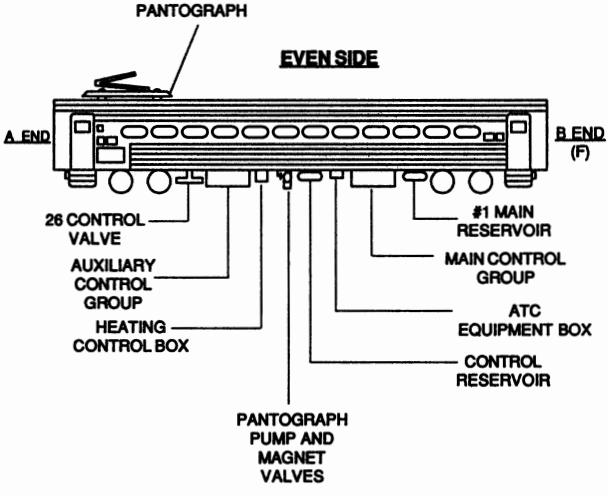

Figure 1-4: Car General Arrangement
Exterior Layout, EVEN Side

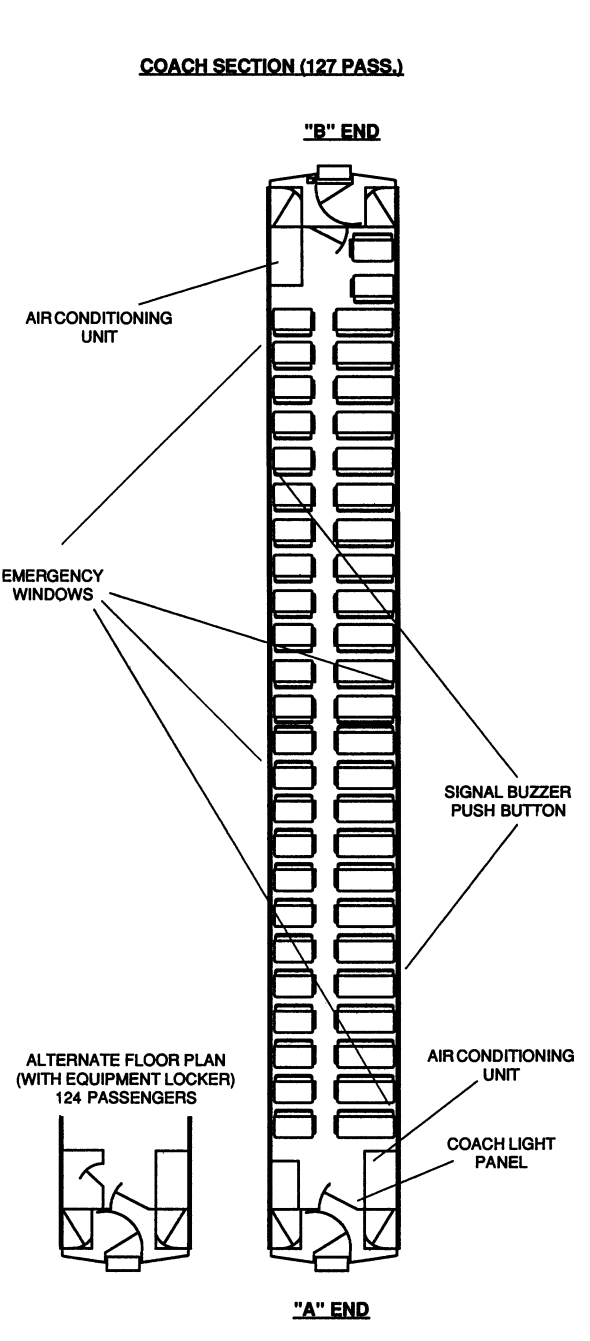

Figure 1-5: Car General Arrangement
Interior Layout, Top View

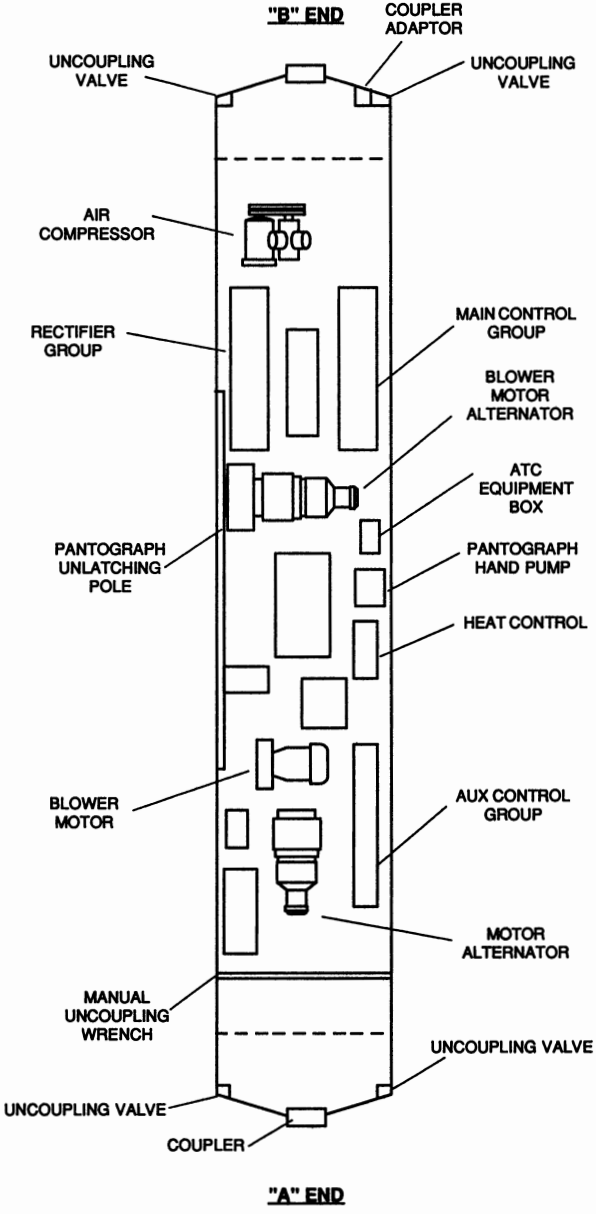

Figure 1-6: Car General Arrangement
Undercar Layout, Top View

1-2.00 CAR DATA

Length Over Couplers (Pulling Faces) ..... 85' 0"

Width of Carbody (Exterior, Max.) ..... 10' 0"

Width of Carbody (Interior, Floor Level) ..... 8' 10-1/4"

Roof Height
(Not including Pantograph, and/or Horn) ..... 12' 6-1/2"

High-Ceiling Height (Min.) ..... 7' 1"

Low-Ceiling Height (Min.) ..... 6' 7-3/4"

Vestibule Side Door Height (Min.) ..... 6' 2-3/4"

Vestibule Side Door Width (Min.) ..... 2' 9-1/4"

Passenger Compartment
End Door Height (Min.) ..... 6' 6-3/4"

Passenger Compartment
End Door Width (Min.) ..... 2' 4-1/4"

Aisle Width (Min.) ..... 1' 7-1/4"

Truck Centers (Distance Between) ..... 59' 6"

Truck Wheelbase ..... 8' 6"

Wheel Diameter ..... 32"

Car Weight (Approx.) ..... 101,375 lbs

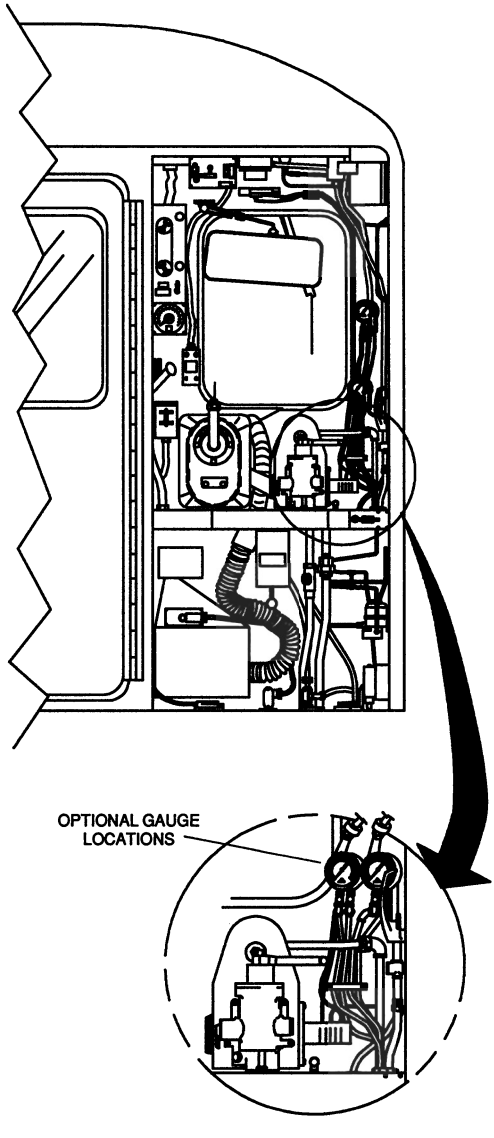

Figure 2-1: Engineman's Operating Station
Operating Cab, Both Ends

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SECTION 2
OPERATING CONTROLS AND INDICATORS

2-1.00 ENGINEMAN'S OPERATING STATION

An engineman's operating station is located at both the "A" (REAR) and "B" (FRONT) END of a car. Engineman operating stations are identical, with the exceptions that the control breaker panel and fire extinguisher are located at the "A" END, and the handbrake is located only in the "B" END.

Control devices, switches, and indicators essential to the operation of a train are located in the Engineman's operating station (Figures 1-1 & 2-1).

2-2.00 ENGINEMAN'S CONTROLS, SWITCHES, AND INDICATORS

This section identifies location and purpose of controls, switches, and indicators used by the Engineman during normal operation of Silverliner II cars (Figure 1-1 & 2-1).

2-2.01 MASTER CONTROLLER

Located in each cab, the master controller is manually operated by rotating its handle to select direction and speed of the car/train (Figure 3-1).

A handle is installed into the master controller, with its lever/pushbutton upward, by inserting its square male end into the square hole in the notching plate and "locked" by the thumb nut.

Notch positions of the master controller are: SAFETY CONTROL/EMERGENCY, OFF/COAST, SWITCH, P1, P2 AND P3.

Inserting the control plug into the CONTROL receptacle will establish cab makeup to enable the following circuits:

a. Snow brake;
b. Cab heat control;
c. ATC System (and radio);
d. Trainline Relay (TLR) -- HVAC;
e. Pantograph up pushbutton;
f. Master controller sequence; and
g. Train heat/AC control -- HVAC.

With the plug in the CONTROL receptacle, and the plunger of the handle pushed in, the handle may be advanced through the running positions to determine the direction and speed of the car/train (ref. Section 3-2.00).

In the event of fault indication during operation, the plug may be removed from the CONTROL receptacle, and placed into the RESET receptacle to reset the overload relays throughout the car/train; master controller handle should be in SAFETY or COAST position. If the fault indicating light extinguishes, the overload relays have reset, and normal car/train operation may be continued by reinserting the plug into the CONTROL receptacle. Train must be stopped with brake valve handle in SUPPRESSION position when performing this procedure because the ATC system will cause an emergency application of the brakes when the control plug is returned to the control plug receptacle.

A special "half plug" may be inserted into the CONTROL receptacle of any master controller on a train. The half plug will not enable propulsion, but will provide the following circuits:

a. Snow brake;
b. Cab heat control;
c. ATC control (and radio);
d. Trainline Relay (TLR) -- HVAC; and
e. Pantograph up pushbutton.

2-2.02 SPEED INDICATORS

Speed indicators are located to the left of the windshield in each cab and provide visual (digital and analog) indication of train speed.

2-2.03 AUTOMATIC AIR BRAKE VALVE

A 26-B-1 Automatic Air Brake Valve is located to the right of the Master Controller in each cab (Figure 4-4). This manually operated brake valve controls the application and release of the train brakes, establishing pneumatic control of brake pipe pressure (ref. Section 4-2.01).

Six brake valve handle operating positions on the valve quadrant initiate pneumatic signals to the brake system of the cars. The brake valve handle positions are:

RELEASE;
MINIMUM REDUCTION;
FULL SERVICE;
SUPPRESSION;
HANDLE OFF; and
EMERGENCY.

2-2.04 SINGLE CAR EMERGENCY BRAKE VALVE

The Single Car Emergency Brake Valve is located in each cab to the left of the windshield below the ATC Aspect Display Unit (Figure 2-2). This valve allows crew members to initiate a single car emergency brake application by moving the valve handle downward to the CUT-IN position. The single car emergency brake valve can only be activated from the car from which the Engineman is operating the consist when brake valve is cut-in.

Note: The Single Car Emergency Brake Valve must be reset manually (Figure 2.2). It must not be used to assist in normal slowing and/or stopping of the equipment because the slide protection is by-passed when this brake is activated, causing flat spotting of the wheels.

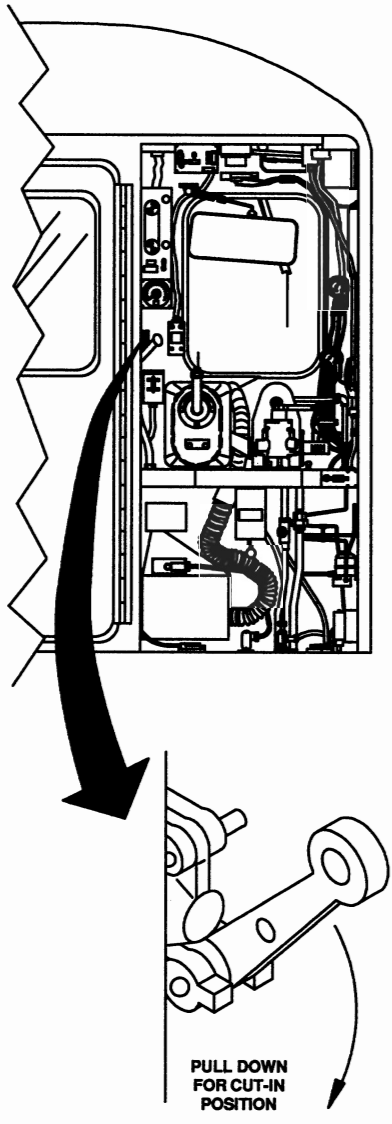


Figure 2-2: Single Car Emergency Brake Valve, in Cab

2-2.05 DUPLEX AIR GAUGES

Located to the right of the brake valve in each cab, the two (2) illuminated duplex air gauges are graduated from 0 to 200 psig, indicating various air brake system pressures. Each gauge has two hands; color-coded RED and WHITE, corresponding with the RED and WHITE numbers on the dial face.

RIGHT GAUGE - Main reservoir pressure is indicated by the RED hand, and equalizing reservoir pressure is indicated by the WHITE hand.

LEFT GAUGE - Brake cylinder pressure is indicated by the RED hand, and brake pipe pressure is indicated by the WHITE hand.

2-2.06 DEADMAN ELECTRIC FOOT PEDAL

Located on the floor at the Engineman's operating side of each cab, the deadman foot switch must be depressed if brake valve handle is in other than SUPPRESSION, HANDLE OFF, or EMERGENCY position or master controller handle is in OFF/COAST position; otherwise, an emergency brake application will occur.

2-2.07 HANDBRAKE

Located on the ODD side of the "B" end vestibule, between the collision-post and corner-post, the gear/chain type handbrake may be operated to apply and hold the two tread brake shoes at the number 1 & 3 wheels of the "B" END truck (Figure 6-1).

The handbrake is applied by rotating the handwheel clockwise until resistance is felt, and released by rotating the handwheel counterclockwise.

2-2.08 PNEUMATIC UNCOUPLING VALVE LEVER

An Uncoupling Valve Lever, located in each cab below the 26-B-1 Brake Valve, is a manually operated spring-return lever. Moving the lever horizontally causes the Uncoupling Valve to energize the Uncoupling Cylinder to separate a pair of coupled cars.

2-2.09 SIGNAL BUZZER PUSHBUTTON

A Signal Buzzer Box, located in each cab to the right of the windshield, is an electric buzzer that permits communication between the Engineman and crew. This buzzer is controlled from pushbutton stations located on the ceiling over each trap, in the coach section, and the outside of the car.

2-2.10 PNEUMATIC HORN PULL CORD

A Pneumatic Horn Pull Cord (red handle), located in each cab to the right of the windshield, operates the car's external audible air horn when pulled downward.

2-2.11 COMMUNICATIONS SYSTEM

The Communications System's Radio Control Panel, consisting of Channel Selector, Volume Control Switch, and Power On Light, is located in the ceiling of each cab to the left of the windshield (Figure 3-3). A Push-to-Talk Box, to the right of the windshield, is used to transmit and receive messages (ref. Section 3-5.00 for operation).

2-2.12 WIPER CONTROL SWITCH

The Wiper Control Switch, located in the cab to the right of the windshield, provides variable speed adjustment to the air-operated windshield wiper motor.

2-2.13 VESTIBULE CEILING SWITCH PANEL

Mounted in the ceiling directly above the Engineman's position (Figure 2-3), switches in the vestibule ceiling Switch Panel control Marker Lights, Vestibule Lights, and Clearance Lights. Power for the Switch Panel is supplied from battery-regulated voltage.

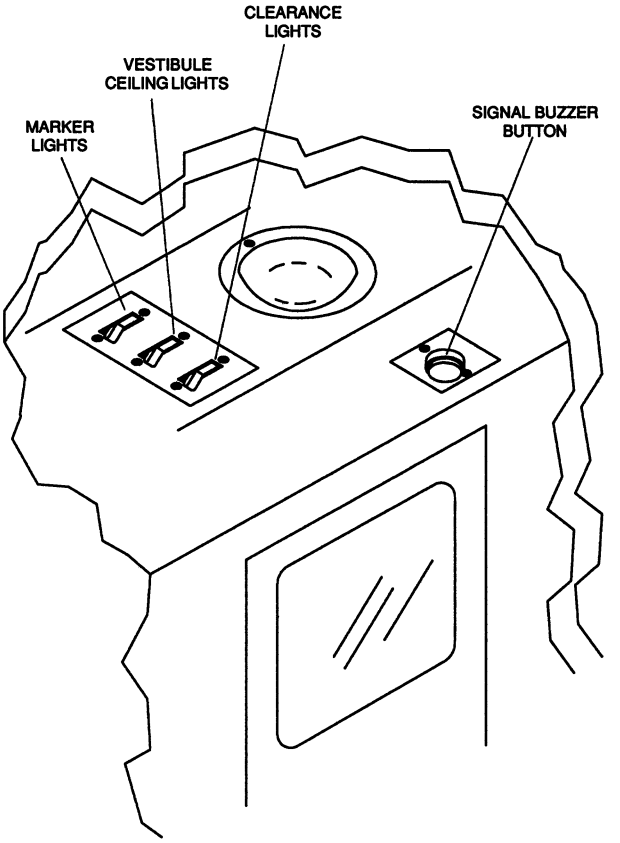


Figure 2-3: Vestibule Ceiling Switch Panel
Operating Cab, Both Ends

2-2.14 COLLISION DOOR POST SWITCH PANEL

Selecting switches on the collision door post switch panel, located in each operating compartment to the left of the master controller (Figure 2-4), have the appropriate positions indicated on the panel cover plate. Apparatus controlled by the switches are identified by plate, stencil, or decal on or near the switch.

a. The top switch cover plate houses the Fault or Overload Indicating Light (on the left) and the Buzzer Cutout Switch (on the right).

b. The second switch cover plate (immediately below the Fault Indicating Light) contains the Headlight Gauge and Sign Switch, and the Cab Heater and Defroster Switch.

c. The third switch cover plate encases the Pantograph (DOWN) Control Switch (on the left) and the Pantograph (RAISE) Control Pushbutton (on the right).

d. The bottom switch cover plate contains the Snow Brake Switch.

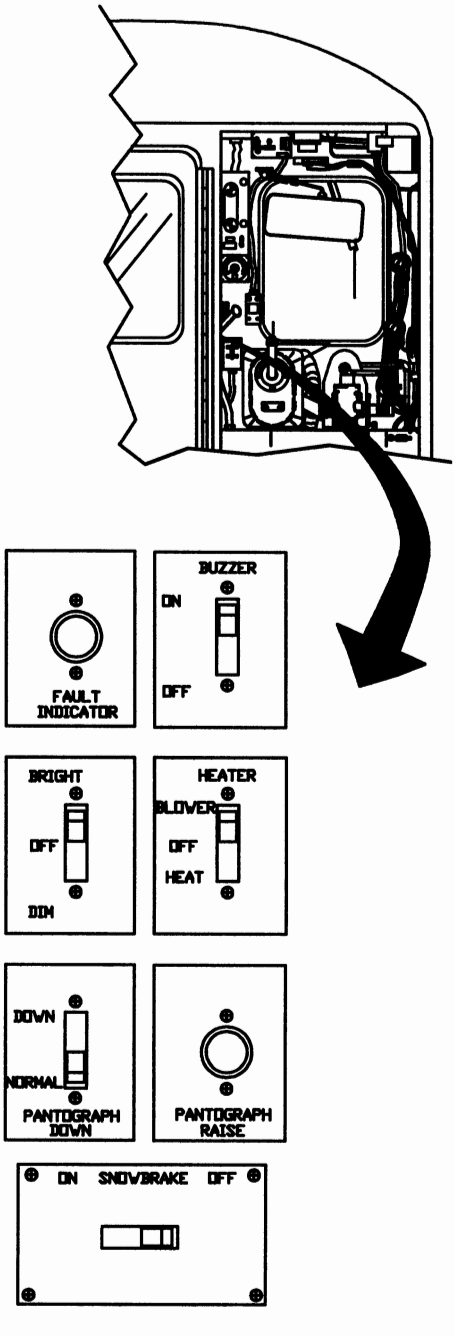


Figure 2-4: Collision Door Post Switch Panel
Operating Cab, Both Ends

2-2.15 CONTROL BREAKER PANEL

Located in the "A" END cab at vestibule bulkhead, to the rear of Engineman's position (see Figures 1-1 & 2-5), the Control Breaker Panel houses fuses, switches, and circuit breakers for the control and protection of devices or auxiliary apparatus.

ON and OFF positions are indicated on the panel cover plate. Apparatus controlled by the breaker is identified by plate, stencil, or decal on or near the breaker.

The Control Breaker Panel is divided into a top section and a bottom section. Identification and location of the circuit breakers on the panel are as follows:

Top Section - Control Breaker Panel

Radio fuses are located at the top of the Control Breaker Panel.

Below the Radio fuses, left to right, are:

Air Conditioning/Heating Circuit Breaker (AC & H) and Three (3) Coach Ceiling Fluorescent Light Circuit Breakers.

Directly below the circuit breakers (above) are, from left to right:

Local Down Pantograph Control Switch;
110 Volt Supply Circuit Breaker (OBT);
Battery Circuit Breaker (BB); and
The Ammeter Probe.

Bottom Section - Control Breaker Panel

Located on the bottom section of the Control Breaker Panel, (left to right) are the following circuit breakers:

Vestibule, Equipment Locker and Clearance Lights;
Emergency Lights;
Marker Lights;
Head Lights; and
Car Number Sign and Gauge Lights.

Directly below the circuit breakers, left to right are:

Motor Cutout Toggle Switches (A-END and B-END);
Propulsion Control Cutout Switch;
Cab Signal Power; and
Air Compressor - Governor Cutout Switch.

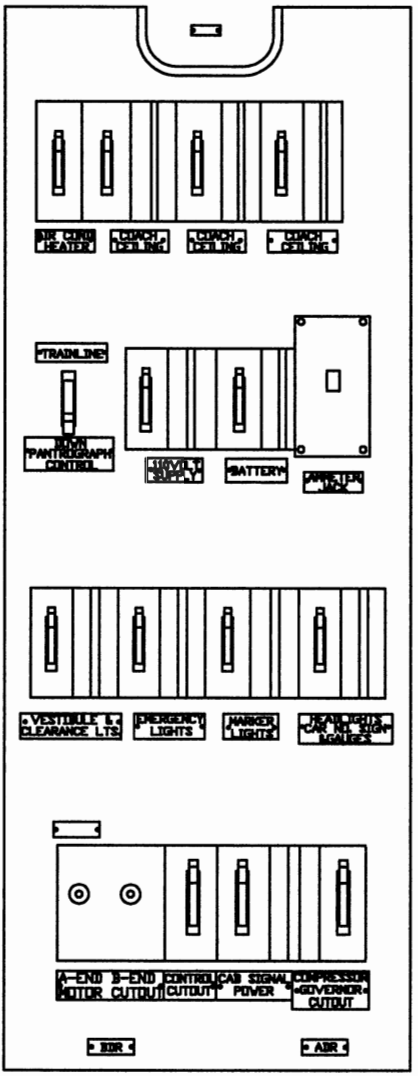


Figure 2-5: Control Breaker Panel
Operating Cab, "A" END

2-2.16 PANTOGRAPH TENSION PRESSURE SWITCH

Located above and to the left of the window, the Pantograph Tension Pressure Switch provides tension adjustment of the pantograph against the catenary. Follow SEPTA instructions concerning proper position of switch.

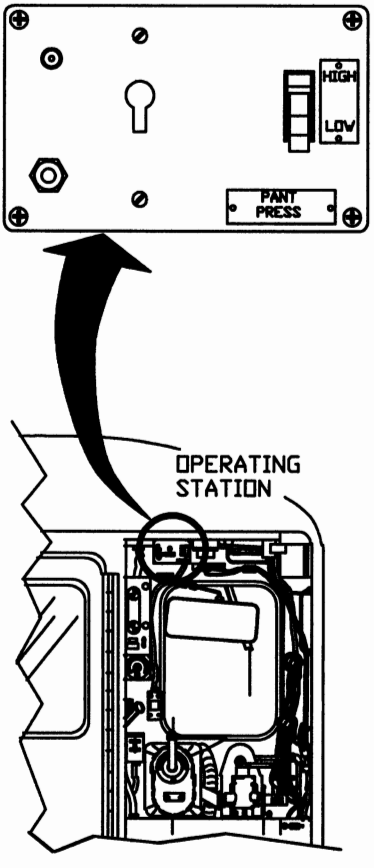


Figure 2-6: Pantograph Tension Pressure Switch
Engineman's Operating Station

2-3.00 CONDUCTOR'S CONTROLS, SWITCHES AND INDICATORS

This section identifies controls, switches, and indicators used by the Conductor during normal operation of Silverliner II cars and their respective locations (Figure 1-5).

2-3.01 EMERGENCY BRAKE VALVES - TRAINLINE

Emergency brake valves (Trainline) are located within the passenger compartment of each car in the ceiling near each vestibule door (Figure 2-7). When activated, these valves will effect an emergency brake application throughout a train. Although intended for conductor use, they are accessible to passengers.

2-3.02 COACH LIGHT PANEL

The Coach Light Panel is located in the passenger compartment, at the "A" END, adjacent to the hinged side of carbody door and consists of three coach ceiling light switches (fluorescent lights) and a low ceiling light switch (incandescent lights).

Fluorescent lighting arrangement on the panel is divided into three electrical circuits, controlled by separate circuit breakers in the "A" END control breaker panel. The fluorescent lights illuminate the full length of the passenger area.

Low ceiling fixtures (incandescent lights) are energized from the 110 volt, 48 cycle outlet-transformer. This circuit also furnishes power to service receptacles in the carbody.

Emergency lights (incandescent), located in the ceiling fluorescent fixtures, include the two (2) low ceiling lighting fixtures. In the event of fluorescent light power source failure, the emergency lights will automatically connect to the regulated power from the storage battery.

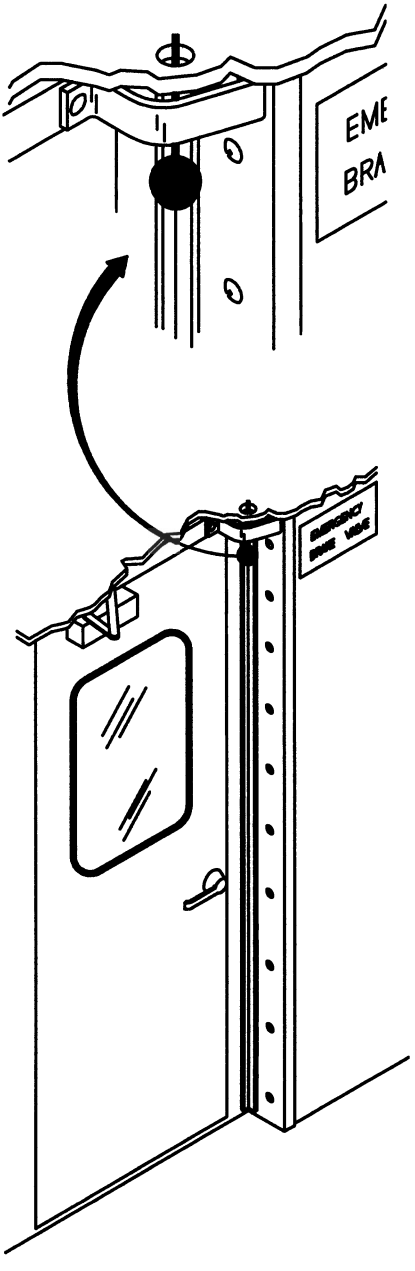


Figure 2-7: Emergency Brake Valve,
Trainline Emergency from Coach

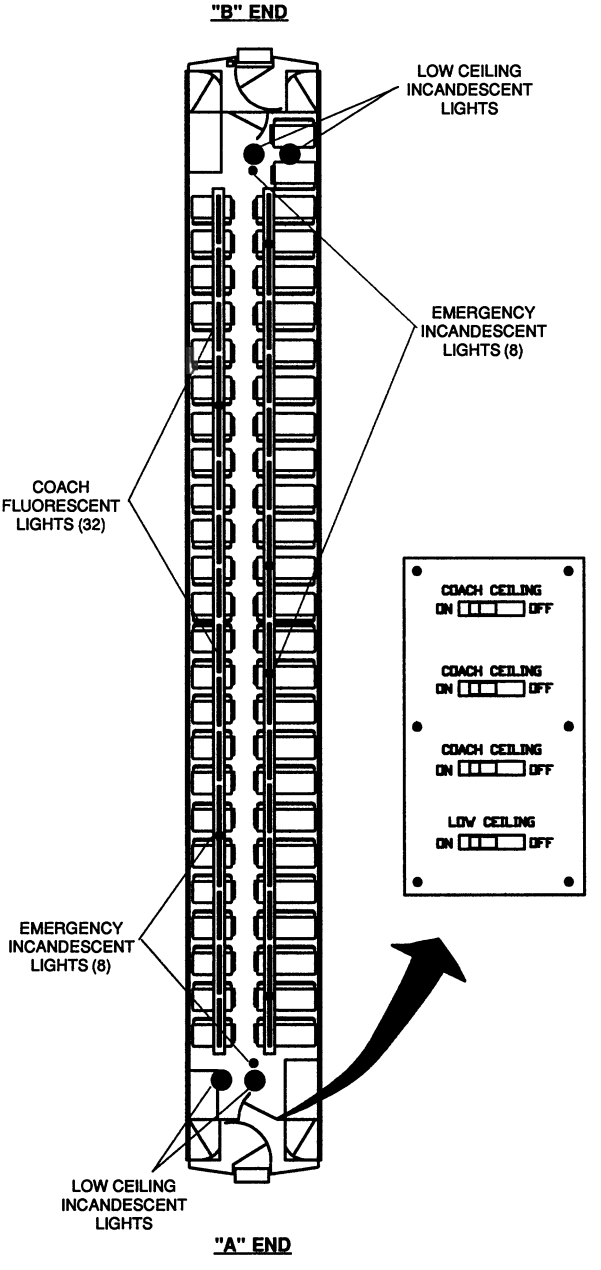


Figure 2-8: Coach Light Panel

2-3.03 CONDUCTOR'S SIGNAL BUZZER PUSH-BUTTON - PASSENGER COMPARTMENT

Conductor's Signal Buzzer Pushbutton stations, located in the passenger compartment of each car above the windows approximately 15 feet from each end (Figure 1-5), permit communication between the Engineman and crew.

2-3.04 CONDUCTOR'S SIGNAL BUZZER PUSHBUTTON - OUTSIDE CAR

Conductor's Signal Pushbutton stations, located outside each car on the end post opposite the Engineman's side of car are accessible from ground, to permit communication between the Engineman and crew.

2-3.05 CONDUCTOR'S SIGNAL BUZZER PUSHBUTTON - VESTIBULE

A Signal Buzzer Pushbutton is located on the ceiling over each trap in the vestibules. They permit communication between the Conductor and the Engineman (Figure 2-3).

2-4.00 CIRCUIT BREAKERS AND OTHER SWITCHES

Thermal type Circuit Breakers used on switchboards for Silverliner II Auxiliary Equipment and Controls are located in the Auxiliary Control Breaker Boxes under floor and hung on the EVEN Side near the center sill. Additional circuit breakers are located on the "A" END in the Control Breaker Panel behind the Engineman in the Operating Cab (ref. Section 2-2.16).

These breakers perform the combined function of a manually operated cut-out switch and a fuse. The operating handle of these breakers will automatically move to its midposition, between OFF and ON, when the breaker trips. If breaker trips, it must be placed fully in "OFF" position, then reset in "ON" position.

Selecting switches have ON and OFF positions that are indicated on the panel cover plate. Apparatus controlled by the switches are identified by plate, stencil, or decal on or near the switch (ref. Section 2-4.01 and Section 2-4.02).

WARNING

ELECTRICAL SHOCK CAN CAUSE SERIOUS OR FATAL INJURY. TO AVOID SUCH INJURY, PERSONNEL SHOULD TAKE CARE AND OBSERVE PRECAUTIONS WHEN NEAR ENERGIZED EQUIPMENT.

2-4.01 MAIN CONTROL GROUP

The Main Control Group enclosure is located undercar, on the EVEN side of each car (Figures 1-4 and 2-9).

Described below are the lights, relays, and reset buttons located in the Main Group (600 Volts), and their respective locations (Figure 2-9):

Located within the Main Control Group enclosure are:

Ground Relay RESET (GR) - The GR provides the main transformer secondary ground protection by sensing current leakage to ground. When the GR is operated, it will energize the reduced power ground relay (RGR) which will trip out (de-energize) the A1, A2, and A3 accelerating contactors. The GR can be reset by:

1. Operator control plug reset, or
2. Local pushbutton reset in main control group, or
3. Manual reset on the GR relay.

Resetting the GR will allow operation of the car in switch (SW) and power (A1) positions only.

Reduced power ground relay (RGR) - when energized (tripped) by the operation of the GR relay, the RGR will prevent the re-energizing of the A2 and A3 contactors until it is reset. The RGR can only be reset manually on the relay itself by pushing in the red tipped lever, after resetting the GR.

Transformer Primary Thermal Overload Relay (THR) - acts on a sustained overload for a period of time sufficient to heat the thermal element. THR operates to close ground switch on roof, causing the Pantograph Lowering Relay (PLR) coil circuit to energize. When THR is tripped "ON" window will change to "TRIPPED". If tripped, crew should never attempt to reset. Notify proper authority.

Slipped Pinion Lockout Relay (SPLR) - disconnected.

Pantograph Lowering Relay (PLR) - primary function is automatic pantograph lowering. PLR operates to close the ground switch on roof in the event of short circuits or unusually heavy current flow, by-passing damaging current around the main transformer, direct to ground.

Sub-station breakers will trip. After the line goes dead the pantograph is automatically lowered and latched. Crew must have permission from the proper authority to reset the PLR.

Transformer Hot Relay (TRF) - picked up by thermal element (THT) when Transformer Coolant temperature exceeds 95 degrees Celsius.

Overload Relay (OLR) - remove overloads which originate in circuits other than the motor circuits. In the event of excessive load current, the overload relay will drop out.

Located in the Main Control Group (right side) enclosed in a casing are the following Fault Indicating Lights:

1. Transformer Hot Indicating Light (TRF) - When TRF or THR relay is energized it lights the TRF local light and energizes the trainline wire to light the fault light in each cab.

2. Ground Relay Indicating Light (GR) - When GR and RGR Relays are energized they light the local GR light and energize the trainline wire to light the fault light in each cab.

3. Overload Relay Indicating Light (OL) - OLR1, 2, & 3, and OLRM 1 & 2 will all light the OL local light and energize trainline wire to light the fault light in each cab.

The Fault Indicating Light (in the cab) will illuminate upon failure of any of the above.

Located in the casing described above, on either side of the fault indicating lights:

Transformer Hot Cooling Fluid Relay RESET Button (TRF) - TRF relay can only be reset by the local TRF pushbutton on the car with the fault.

Overload RESET Button (OLR) - OLR1, OLR 2, & OLR 3 remove overloads which originate in circuits other than the motor circuits. Can be reset with control plug or local pushbutton on the car with the fault.

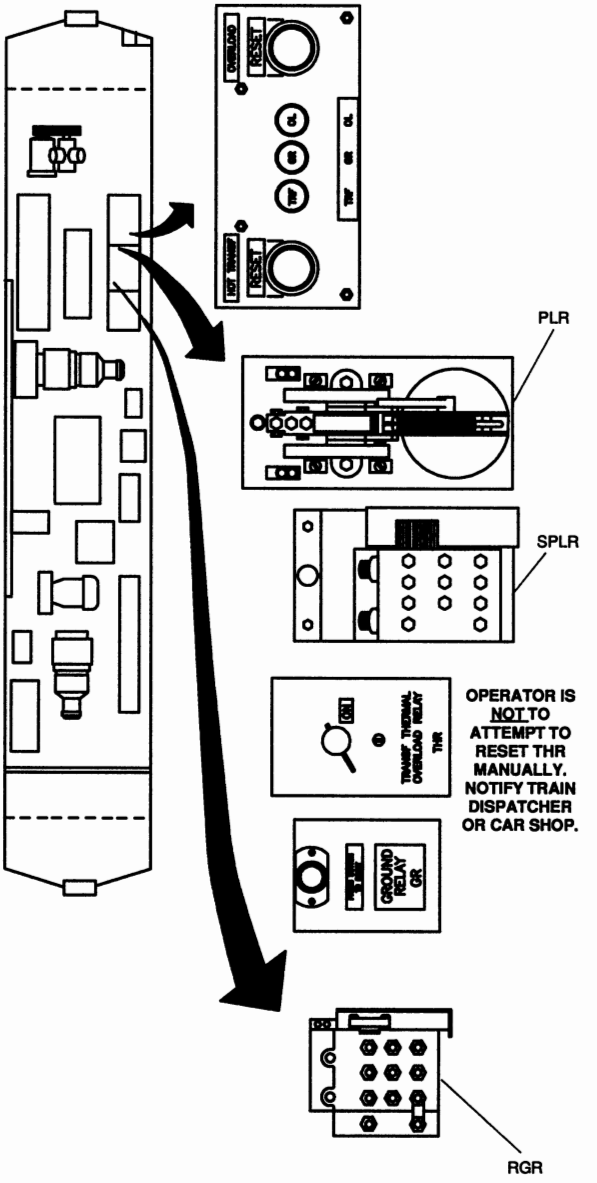


Figure 2-9: Fault Indicating Lights and Reset Buttons
Main Control Group, Undercar

2-4.02 AUXILIARY CONTROL GROUP

The Auxiliary Control Group enclosure is located undercar and hung on the EVEN Side (near the center sill) of each car (Figures 1-4 and 2-10).

Circuit breakers housed in the Auxiliary Group (600 volts) and respective locations, left to right, are:

Transformer Coolant Pump Circuit Breaker (PPB) - 572 VAC supply to cooling pump. Protects pump from short circuits. Also acts as a cut-out switch for M1-M4 contactors and A1-A3 contactors (local 24 to 40 VDC).

Cab Heater Circuit Breaker (CHB1) - 572 VAC circuit breaker protection for cab heat (both end cabs).

Floor Heater Circuit Breakers (FHB2) & (FHB1) - 572 VAC circuit protection for floor strip heaters in the passenger compartment. FHB1 is for 1st stage heat, FHB2 is for 2nd stage heat and layover.

Overhead Heater Circuit Breakers (OHB2) & (OHB1) - 572 VAC circuit protection for OHB1 - "A" END overhead heat, and OHB2 - "B" END overhead heat.

Protective Heat Circuit Breaker (PHB) - 115 VAC circuit protection for protective heat circuits: No. 1 main reservoir drain heater, air compressor dryer heater.

Blower Motor Alternator Set Circuit Breaker (BMAB) - 572 VAC circuit protection for the blower motor alternator.

Motor Alternator Set Circuit Breaker (MAB) - 572 VAC circuit protection for the motor alternator.

Descriptions and locations for the circuit breakers housed in the Auxiliary Group (220 Volts) left to right, are:

Air Conditioning Alternator Circuit Breaker (ACAB) - 220 VAC circuit breaker protection for all power supplied by motor alternator output.

Air Compressor Circuit Breaker (ACB) - 220 VAC circuit protection for the air compressor motor.

Lighting Circuit Breaker (FLB) - 220 VAC circuit protection for all fluorescent ceiling lighting for the passenger area.

Rectifier Transformer Circuit Breaker (RTB) - 220 VAC circuit protection for the DC rectifier and battery charging circuits.

Blower Motor Set Circuit Breaker (BMB) - 220 VAC circuit protection for the blower motor.

Outlet Transformer Circuit Breaker (OTB) - provides 220 VAC protection to the T3 Transformer -- supplies power (110 VAC) to cab heater blower motor and convenience outlet receptacles.

Rectifier Circuit Breaker (RB) - 24 to 40 VDC circuit protection for rectified DC output and battery charging circuits.

Traction Control Circuit Breaker (MCB) - 24 to 40 VDC circuit protection to traction motor control circuit and trainline circuit (B+, B-).

AC-1 Contactor Reset (AC-1) - thermal protection drop-out power to air compressor on overload conditions. Yellow trip indicator with manual RESET at overload.

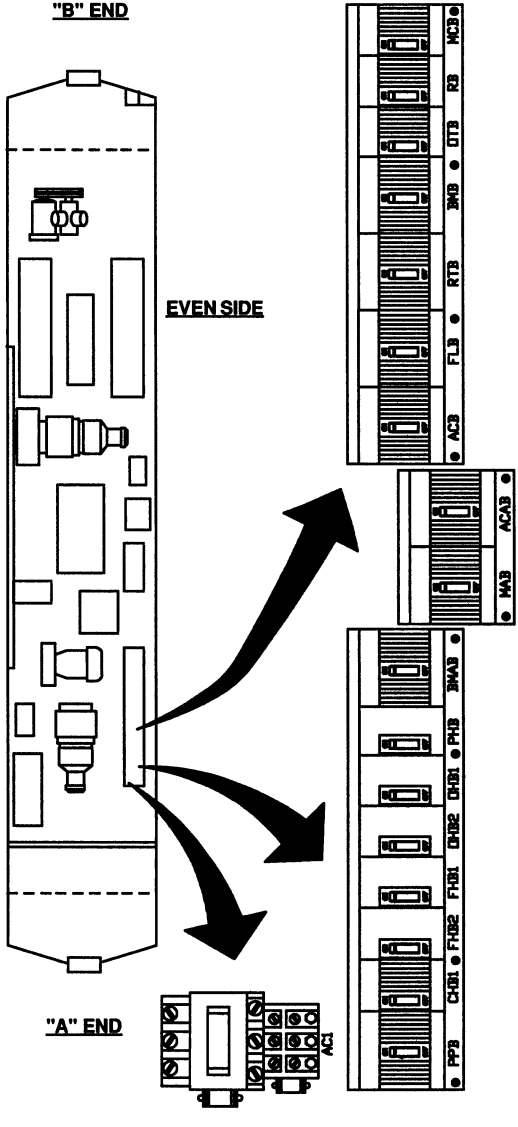


Figure 2-10: Circuit Breaker Panel
Auxiliary Control Group, Undercar

SILVERLINER II - OPERATOR MANUAL

SECTION 3
CAR OR TRAIN OPERATION

3-1.00 PREPARING TRAIN FOR SERVICE

WARNING

POSSIBLE ELECTRICAL SHOCK AND INJURY TO PERSONNEL IF CONTACT WITH LIVE HIGH VOLTAGE WIRE IS ESTABLISHED.

3-1.01 PRE-SERVICE INSPECTION

Before a car/train is released for service, a pre-service inspection must be performed and specific devices must be "set up" for safe operation. The following procedures define general pre-service inspections and device "set up":

Perform a walk around inspection -- visually inspect the equipment for defects (i.e. opened electrical boxes, brake rigging hanging, misaligned brake shoes, etc.) that would prevent safe movement of the train.

EQUIPMENT INSPECTION

Perform the following Equipment Inspection Requirements prior to making the brake tests:

a. All Cut-Out Cocks and Portions used to couple cars are in proper position.
b. Various Cut-Out Cocks and Switches used in connection with ATC system are properly positioned and sealed. Seals will be applied to enclosures where cut-out cocks are not readily accessible for inspection.
c. Air Regulation Pressure devices are functioning properly and are adjusted to prescribed pressures.
d. Brake Shoes are in line with wheel tread.
e. Wheels are in suitable condition for service.
f. Handbrake is released on all trailing units, except when it is necessary to secure the equipment.
g. Accumulated oil and water condensate is drained from the main reservoir system.

h. Brake Valve Cut-Out Cocks at all non-operating stations are in the "cut-out" position.
i. Safety Chains between the operating units and on leading/trailing ends of units are properly secured.
j. Electrical Coupler Doors at leading/trailing ends of units are closed, dead-in-tow hose properly secured.
k. Train and related apparatus are in proper working condition for the service in which they are intended to operate.

3-1.02 SETTING UP THE CONTROL STAND

The following procedure describes the proper set up of the Control Stand:

1. Close all circuit breakers in Auxiliary Group and "A" End Breaker Panel on all cars.
2. Manually unlatch pantographs on all cars (ref. Section 6-1.04).
3. Install master controller handle into master controller (SAFETY CONTROL position) in the operating cab (ref. Section 2-2.01).
4. If the Fault Indicating Light is illuminated, insert control plug into RESET receptacle of master controller to reset the overload relays. If Fault Indicating Light does not extinguish, follow Trouble-shooting Instructions of Section 5-3.00.
5. When Fault Indicating Light extinguishes, if illuminated, remove control plug from RESET receptacle and insert it into CONTROL receptacle.
6. Open brake valve cut-out cock to OPEN-LOCK position.
7. Depress and release cab signal acknowledge pedal. Depress deadman pedal.
8. Insert Brake Valve Handle into Brake Valve. Move handle to RELEASE position. Brake pipe will begin charging.
9. After brake pipe and main reservoirs have been sufficiently charged. Conduct required brake test.

10. Turn on necessary headlights, vestibule, and clearance lights. Assure that conductor has turned on marker lights at rear of train, removed wheel chocks, and released all hand brakes.

CAUTION

Do not use the SUPPRESSION position when charging the brake system. Charging the brake system in SUPPRESSION will cause loss of brake cylinder pressure due to insufficient charging of the control reservoir.

The duplex air gauges, when system is fully charged, must read:

ER (Equalizing Reservoir) - 110 psig
BP (Brake Pipe) - 110 psig
MR (Main Reservoir) - 130-140 psig
BC (Brake Cylinder) - 0 psig

See Tables 3-1, 3-2, and 3-3 for information regarding System Pressure, Brake Pipe Reduction, and Emergency Brake Applications.

3-1.03 STANDARD PRESSURE SETTINGS

Air pressure regulating devices on Silverliner II cars must be adjusted for the following standard pressures:

PRESSURE (PSIG) - TABLE 3-1

	PRESSURE (psig)
Control Reservoir (Auxiliary Devices)	90
Main Reservoir Safety Valve	150
Brake Pipe	110
Equalizing Reservoir	110
Main Reservoir	130 - 140

BRAKE PIPE REDUCTION - TABLE 3-2

	SERVICE REDUCTIONS (psig)	BRAKE CYLINDER PRESSURE (psig)
Silverliner II	26	65*
*Indicating Service Portion Limiting Valve Setting		

EMERGENCY AND SINGLE CAR EMERGENCY BRAKE APPLICATIONS - TABLE 3-3

	BRAKE CYLINDER PRESSURE (psig)	
Silverliner II	77 - 100	Emergency application (pressure varies with respect to passenger load)
	Equal to Main Reservoir	Single car emergency brake application

3-2.00 OPERATING PROCEDURES

3-2.01 STARTING A CAR OR TRAIN

Before a Silverliner II car or train may be started, a pre-service inspection and series of brake system and cab signal system tests must be performed successfully (ref. Sections 3-1.00 through 3-1.03).

With pantographs raised on all cars to be operated, all circuit breakers set in the ON position, reservoirs fully charged, deadman foot pedal depressed, the brake valve handle in the RELEASE position, and all handbrakes released, Silverliner II cars/trains are started through the following procedures:

1. Move master controller handle from SAFETY CONTROL/EMERGENCY position to OFF/COAST position. NOTE: The OFF/COAST position will establish train direction.

2. Movement of master controller handle to positions SWITCH, P1, P2, or P3 will energize propulsion, moving the car/train in the direction established.

Acceleration and speed is provided in varying combinations per the acceleration sequence and speeds of Table 3-4.

ACCELERATION SEQUENCE AND SPEEDS - TABLE 3-4

HANDLE POSITION	MAXIMUM SPEED MPH
SWITCH	15
P1	35
P2	60
P3	85

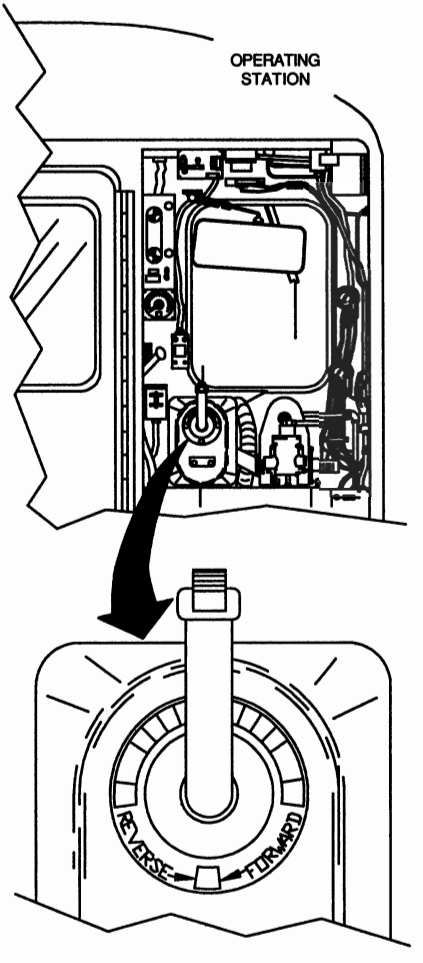


Figure 3-1: Master Controller
Engineman's Operating Stations

3-2.02 CHANGING OPERATING STATIONS

The following procedures must be observed when an Engineman's operating station is changed from one cab to another (Figures 1-1 and 2-1):

1. Make full service brake application and then initiate an emergency application by releasing deadman foot switch, or placing brake valve handle in EMERGENCY position.
2. Remove brake valve handle.
3. Remove control plug.
4. Loosen thumb nut and remove master controller handle.
5. CUT OUT brake valve cut-out cock.

At new cab, proceed as follows:

1. Insert master controller handle.
2. Insert control plug.
3. Insert brake valve.
4. CUT IN brake valve.
5. With deadman foot switch depressed or master controller in COAST position, place brake valve handle in RELEASE position and charge brake system.
6. Do appropriate brake test(s).

3.2.03 MAXIMUM SPEEDS

Detailed in the following table are maximum speeds permitted under various operating conditions for the Silverliner II cars (Table 3-5).

MAXIMUM SPEEDS - TABLE 3-5

	MAXIMUM SPEED
Silverliner II 201-219, 251-269, 9001-9017	85 MPH
Air Spring deflated or over-inflated	30 MPH
Diverting through crossovers or turnouts	15 MPH
Overriding buffer plates	15 MPH
Diverting through crossovers or turnouts	5 MPH

3-3.00 STORING EQUIPMENT INSTRUCTIONS

3-3.01 LAYOVER

The following procedure describes how to properly store equipment with the pantograph lowered:

1. Remove control handles.
2. Lower pantograph(s) with trainline pantograph lowering switch. When pantograph(s) latch(es), return switch to normal position.
3. Apply sufficient handbrakes on train.
4. Open battery circuit breaker (BB) in "A" END control breaker panel.
5. Shut off all headlight, marker, vestibule, coach and clearance lights.
6. Lock all carbody doors.
7. Chock wheels.

3-4.00 COUPLING AND UNCOUPLING CARS

WARNING

TO PREVENT ACCIDENTAL MOVEMENT, APPLY THE HANDBRAKE(s) AND CHOCK THE WHEELS OF THE CAR(s) TO BE "SET OUT" AFTER UNCOUPLING CARS .

Silverliner II cars have a spear type N-2-A, fully automatic coupler. The N-2-A coupler is a notched main coupler spear with a companion female fitting.

Coupling of the cars is automatic; both electric and air trainline connections are made when mechanical coupling is accomplished.

Mechanical and electrical coupling of individual cars (Figure 3-2) is accomplished as follows:

1. Cars to be coupled must have their couplers aligned and brought together at speed not exceeding 2 MPH.
2. As cars are brought together, the main coupling pin of each coupler head enters the funnel of the opposing coupler.
3. When pins have completely entered the funnels, latches in each head snap into the notches in the main coupling pins, locking the coupler heads together.

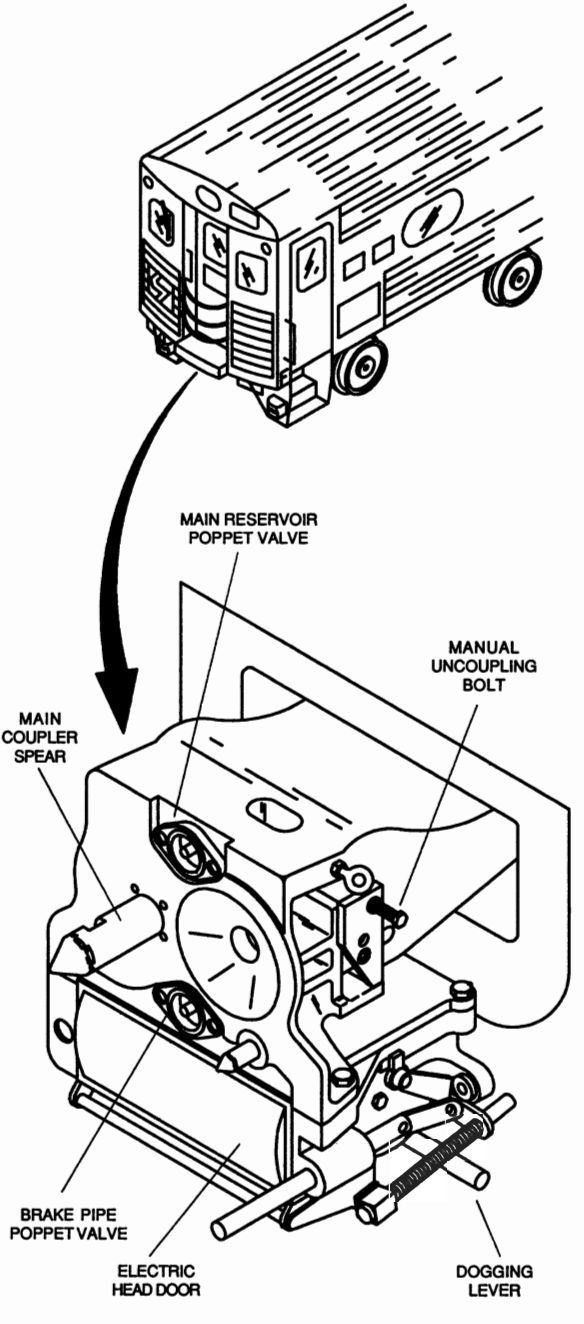


Figure 3-2: Coupler

3-4.01 COUPLING PROCEDURES

The Engineman should operate the equipment from the end of the car that is to be coupled for maximum control and visibility.

The following procedures must be observed **before** coupling cars:

1. The equipment from which the coupling is being made must be stopped with not less than 15 feet between couplers.
2. Observe that cars to be coupled do not have coupler adapter in place and that manual uncoupling screw is fully screwed in.
3. The Engineman should then move unit to between 3 and 5 feet from the equipment to be coupled to and stop.
4. A crew member must then be on the ground (roadbed) and should properly align both couplers so that they are within the safe gathering range (4" maximum misalignment in any one direction).
5. Apply handbrakes to equipment to be coupled.
6. Remove chocks.

The following procedures must be observed **during** coupling:

NOTE: Maximum speed during coupling is not to exceed two (2) miles per hour.

1. The crew member who is on the ground must give the proper signal to initiate coupling.
2. Engineman energizes snowbrake and releases air brake.
3. The Engineman must move the equipment to affect coupling.
4. Inspect couplers where coupling was made to insure that mechanical lock is engaged on both cars.

The following procedures are to be observed **after** coupling:

1. Engineman places automatic brake valve handle in emergency position to recover and recharge brake pipe.
2. Assure that coupler locks are in proper position.
3. Assure that there are no air leaks at the coupling.
4. Assure that trainline brake pipe and main reservoir cocks are in "Open" position.
5. Assure that electric heads are in un-dogged position.
6. Test the communicating buzzer.
7. Attach passenger safety chains between cars.
8. Perform appropriate air brake tests and remove handbrakes.

3.4.02 COUPLING ON CURVES

If possible, avoid coupling on sharp curves. If necessary to couple on curves, observe the following procedure:

NOTE: Silverliner II cars are equipped with coupler centering springs. When the alignment is beyond 4" limits, unhook the spring opposite the direction in which the coupler must move to align, to permit the coupler to move into alignment.

1. When coupling on other than a straight track, a crew member should descend to the roadbed to ensure that couplers are within gathering range.
2. Manually disconnect centering springs.
3. Position couplers so the tip of the notched male coupling pin is within the cone area of the mating female fitting on the opposite coupler.
4. Couple cars (ref. Section 3-4.01).

3-4.03 AUTOMATIC/PNEUMATIC UNCOUPLING

The following procedures are to be observed when affecting an automatic/pneumatic uncoupling:

1. Disconnect safety chains from between cars to be uncoupled.
2. Apply handbrake(s) to car(s) that will be left standing. If necessary, wheels should be chocked after uncoupling is affected.
3. Reduce equalizing reservoir pressure 20 pounds.
4. At the location where uncoupling is to be made, after signal is received that brake application is completed:

    a. Pull uncoupling valve on cars to be moved and listen for lock blocks to pop open.
    b. Signal Engineman to apply power to uncouple the cars.
    c. Brake pipe is vented at an unrestricted rate on the car(s) left standing, resulting in an Emergency application.
    d. Check cars left standing to assure that they do not roll and that hand brakes are applied and wheels are choked.

NOTE: Valve must be held ON until cars are sufficiently separated.

3-4.04 MANUAL UNCOUPLING

1. Apply handbrake to car(s) that will be SET OUT.
2. Make a 20 pound equalizing reservoir pressure reduction.
3. Using the Manual Uncoupling Wrench (ref. Section 6-1.04), turn the coupling bolt out, on the side of both couplers. The bolt cannot be removed entirely, but will turn out enough to unlatch the mechanical notched (male) device so that uncoupling is accomplished.
4. Activate uncoupling valve on car to be moved.
5. Release brakes on cars to be moved.
6. Apply power to separate cars.
7. Chock cars that are left standing.

3-4.05 DOGGING COUPLER

Dogging the coupler separates the electrical trainline circuit between cars.

3-5.00 COMMUNICATIONS OPERATION

The Communciations System provides two-way communication between the tower operators or train dispatcher and the Engineman or the Train Crew by means of the car radio system.

The Communications system is hard-wired to the battery and protected by RADIO fuses ("A" END control breaker panel).

The Radio Control Panel, consisting of Channel Selector, Volume Control Switch, and Power On Light is located in each cab to the left of the windshield in the ceiling (Figure 3-3).

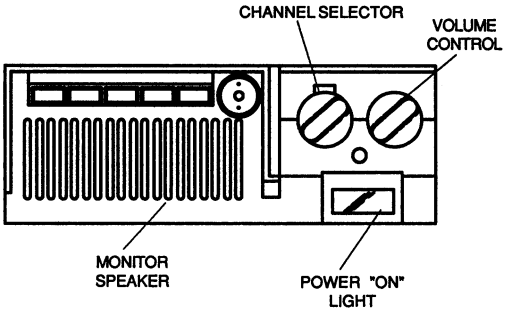
The following controls are located on the Radio Control Panel:

a. Channel selector knob - permits selection of desired channel for transmitting and receiving. There are 12 channel positions, numbered 1 through 12.
b. Volume control switch - permits setting of desired listening level of the monitor speaker by turning the control knob (clockwise to increase) when transmissions are received.
c. Power on light - illuminates when the panel is energized.
d. Monitor speaker - permits Engineman to hear all radio transmissions on the channel selected.

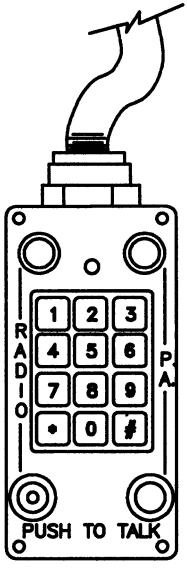
Located in each cab to the right of the windshield, the Push-To-Talk Box consists of a Mode Switch and Microphone, used to transmit and receive messages:

a. Mode switch - depress button to transmit messages, release to receive messages.
b. Microphone - at normal voice level, it is necessary to speak directly at the panel.

RADIO



PUSH TO TALK BOX



NOTE

SILVERLINER II IS NOT EQUIPPED WITH PA SYSTEM.
"PUSH TO TALK" BUTTON NOT OPERABLE.

Figure 3-3: Communications System
Operating cab, Both Ends

3-5.01 COMMUNICATIONS SYSTEM ACTIVATOR

The communication control head panel (RADIO) is constantly powered by the battery, and activated when the control plug is inserted into the CONTROL receptacle of a master controller, and deactivated whenever the control plug is removed. The radio may only be activated at the control stand from which the Engineman is operating.

3-5.02 RADIO COMMUNICATIONS PROCEDURES

Receiving with car radio:

1. Turn channel selector switch to desired frequency.
2. Turn volume knob clockwise, setting desired listening level.

Transmitting with car radio:

1. Turn channel selector switch to desired frequency.
2. Listen to assure that channel is clear before beginning transmission.
3. When channel is clear, depress push-to-talk button and identify yourself and the station being called.
4. Speak directly towards the panel at a normal voice level.

3-6.00 TEMPERATURE CONTROL OPERATION

Silverliner II cars are equipped with a fully automatic, independent temperature control system, manual change-over from winter to summer operation is not required. When activated, heating, ventilating, and air conditioning (HVAC) functions are thermostatically controlled to maintain preset passenger compartment air temperatures. Each operating compartment is equipped with a manually operated cab heater/ defroster (Section 3-6.02).

3-6.01 ACTIVATING THE TEMPERATURE CONTROL SYSTEM

Passenger compartment air temperature control in each car is activated automatically when:

a. the pantograph is raised;
b. a control plug is inserted into the CONTROL receptacle of any master controller; and
c. the Air Cond. and Heat circuit breaker in the "A" END control breaker panel is set to the ON position.

3-6.02 CAB HEATER/DEFROSTER CONTROL

Control of the cab heater/defroster, located in each operating compartment beneath the windshield, is enabled when:

a. a control plug is inserted into the CONTROL receptacle of same end master controller; and
b. the Air Conditioning and Heat circuit breaker in the "A" END control breaker panel, is set to the ON position.

When needed, the cab heater/defroster is manually operated by a three position switch located in each operating compartment (Figure 2-4).

Switch positions are:

1. CENTER - heater and blower OFF;
2. DOWN - heater and blower ON; and
3. UP - heater OFF and blower ON

3-6.03 DEACTIVATING THE TEMPERATURE CONTROL SYSTEM

HVAC is automatically deactivated throughout a train by removing the control plug from the CONTROL receptacle.

HVAC is manually deactivated in an individual car by setting the Air Cond. and Heat circuit breaker in the "A" END control breaker panel, on that car, to the OFF position.

3-7.00 SIGNAL BUZZER OPERATION

Signal Buzzer operation is activated through the Conductor's Signal Buzzer equipment:

a. The Conductor's Signal Buzzer Box, located in each cab to the right of the windshield is an electric buzzer that permits communication between the Engineman and crew.
b. Pushbutton stations (see below) control the buzzer.

Conductor's Signal Buzzer Pushbutton stations are located in the passenger compartment, above the windows, approximately 15 feet from each end (Figure 1-5), outside each car on the end post opposite the Engineman's side of car and accessible from ground, and on ceiling over each vestibule trap door. To activate Signal Buzzer, sound the buzzer by depressing the pushbutton.

SILVERLINER II - OPERATOR MANUAL

SECTION 4
OPERATING SUBSYSTEMS

4-1.00 ELECTRICAL SYSTEM

Electrical Systems of Silverliner II Cars are comprised of the High Voltage, Propulsion Power, and Auxiliary Power Subsystems (Figure 4-1).

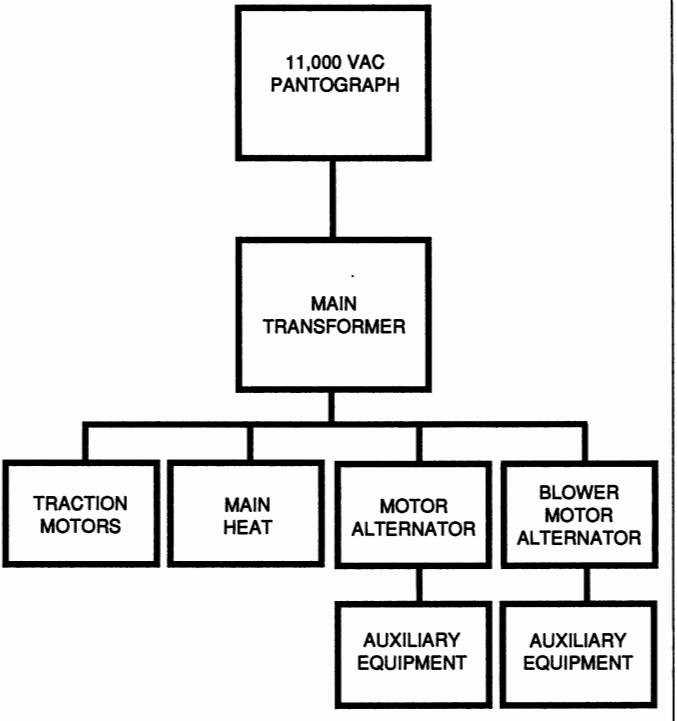


Figure 4-1: High Voltage Electrical System
Functional Block Diagram

4-1.01 HIGH VOLTAGE ELECTRIC SUBSYSTEM

The 11,000 VAC primary power from the overhead catenary is conducted to the Main Transformer primary windings through the Pantograph and High Voltage leads. The overhead catenary supplies electrical power for traction, main heat, the motor alternator, and blower motor alternator (Figure 4-1).

WARNING:

WHEN PANTOGRAPH IS IN CONTACT WITH THE OVERHEAD CATENARY HIGH VOLTAGE IS PRESENT. CONTACT WITH HIGH VOLTAGE SOURCE CAN CAUSE DEATH.

Mounted on the roof over the "A" END, the Pantograph collects current for car operation by contact with the catenary.

The Main Transformer is non-PCB fluid immersed with forced air cooling and is mounted under the center sill of the car. Overheating of the cooling fluid will open the Transformer Hot Cooling Fluid Relay (TRF), disconnecting traction power until the transformer cools. The Transformer Primary Overload Thermal Relay (THR) acts on overload sustained for enough time to heat the thermal element. The THR operates to close the roof mounted ground switch which grounds the catenary, removing overhead power, causing the Pantograph Lowering Relay (PLR) to trip.

The main transformer has one 11,000 volt primary winding and three secondary windings with output voltages of 637, 572, and 546 volts. Each secondary is shunted by a resistor-capacitor circuit to filter telephone interference frequencies and provide surge absorption protection for the silicon rectifier cells.

4-1.02 PROPULSION POWER ELECTRIC SUBSYSTEM

The Propulsion Power Electric Subsystem (Figure 4-2) divides the 11,000 VAC from the catenary to supply propulsion power and car auxiliary electric loads.

MAIN TRANSFORMER

The Main Transformer has three (3) secondary windings (A, B, and C) with output voltages of 637, 546, and 572 VAC respectively. Varying combinations of secondary outputs through Rectifier Panels supply DC power to Traction Motors to adjust car speed. Output of the "A" secondary is controlled from 0 to 637 volts providing automatic acceleration control.

TRANSFORMER COOLANT PUMP

Circulates cooling fluid from the transformer to the heat exchanger to maintain proper transformer operating temperatures.

MAIN CONTROL GROUP

The Main Control Group, located beneath the car, consists of motor contactors (with individual overload relays), a reverser, current measuring reactors, and a static type card panel.

NOTE: For functional information and "reset" locations refer to Section 2-4.01.

STATIC PANELS

Contain static cards that control traction and acceleration.

RECTIFIER CONTROL GROUP

Contains mechanical and electrical equipment necessary for converting AC power to DC for propulsion power.

SMOOTHING REACTOR

A smoothing reactor is provided to smooth the pulsations of the output of the rectifiers. Power is then supplied to the traction motors. The reactor is cooled by forced air circulation from the BMA.

MASTER CONTROLLER

Energizes the trainline control wires which feed control signals to devices located in the Main Control Group. Control signals are simultaneously trainlined to control devices of other cars in a multiple unit consist in order to control application of power to traction motors of each car in the train consist.

If any of the controls in the lead cab fail, the train can be operated from another car in accordance with SEPTA Operating Instructions.

TRACTION MOTORS

Each car has four direct-current traction motors, rated for 156 horsepower at 1,700 rpm.

Torque is transmitted from the drive motor to the wheels through a parallel drive type gear unit, coupled to each axle.

A Wheel Slip Protection System measures each axle's rpm to detect wheel slip. Speeds of the four axles are compared to determine a slip condition. Slip conditions are automatically corrected by reducing tractive effort on a car losing adhesion.

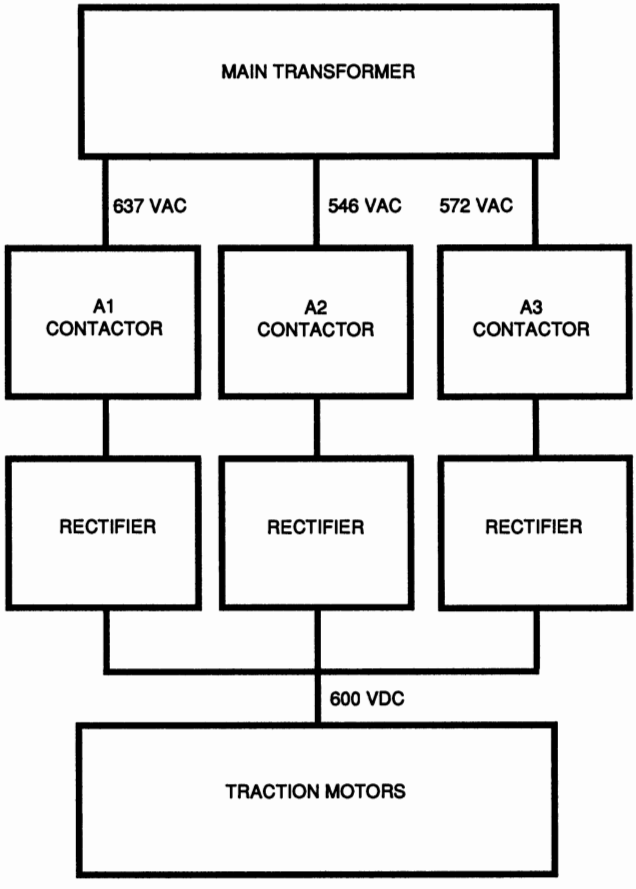


Figure 4-2: Propulsion Power Electric Subsystem Functional Block Diagram

4-1.03 AUXILIARY POWER ELECTRIC SUBSYSTEM

MOTOR ALTERNATOR/BLOWER MOTOR ALTERNATOR

Auxiliary power for Silverliner II cars is furnished by the Motor Alternator (MA) Set and the Blower Motor Alternator (BMA) Set (Figure 4-3):

Main Transformer "C" secondary winding 572 VAC output supplies power to the MA and BMA Sets.

The MA Set furnishes 220 VAC, 48 hz, 3 phase power to operate the following auxiliary control equipment: air compressor motor; refrigerant compressor motors; blower; exhaust and condenser fans.

The BMA Set supplies 220 VAC, 48 hz, 3 phase power through circuit breaker BMB to operate the Blower Motor; battery charging; fluorescent lighting; convenience receptacle; and cab heater blower. The Blower Motor supplies air circulation through ductwork to the main transformer heat exchanger and smoothing reactor cooling fins.

BATTERY

The Battery is comprised of 26 single nickel-iron alkaline cells, producing between 1.0 and 1.5 VDC per cell and supplies power to the Radio, ATC System, Traction Controls, Headlights, Markers, Clearance Lights, and Buzzer systems. If the light switches are ON, and power is lost to the fluorescent lighting system, the battery is connected to emergency incandescent lighting to illuminate the passenger area. The Battery is rated for 80 ampere hours at 5 hour rate. Jumper connections between individual cells provide approximately 37.5 volts and are regulated in the battery charging system by the Lamp Regulator (LR).

AUXILIARY CONTROL GROUP

Consists of protective circuit breakers and contactors for auxiliary components, a rectifier for battery charging, transformers, and voltage regulators for two motor-alternator sets.

NOTE: For circuit breaker location and functional information, refer to Section 2-4.02.

Auxiliary components are located inside the Auxiliary Control Group covers, mounted undercar at the EVEN numbered side sill. Devices within this group provide the means for controlling the HVAC, Air Compressor, Battery Charging, and Car Lighting systems.

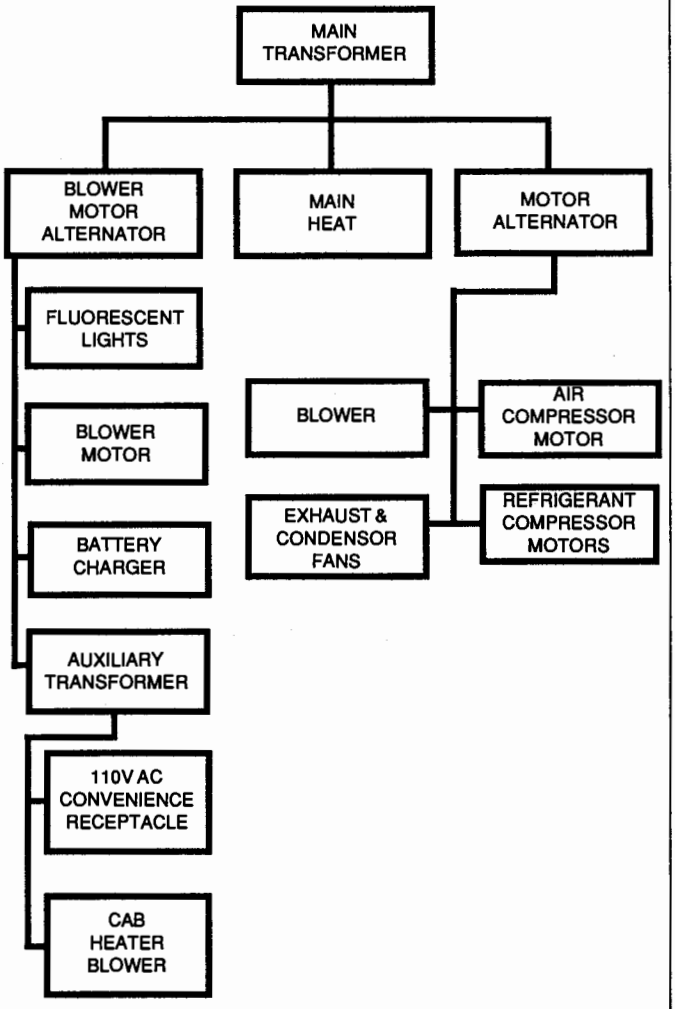


Figure 4-3: Auxiliary Power Electric Subsystem Functional Block Diagram

4-2.00 AUTOMATIC AIR BRAKE SYSTEM

4-2.01 SYSTEM OPERATION

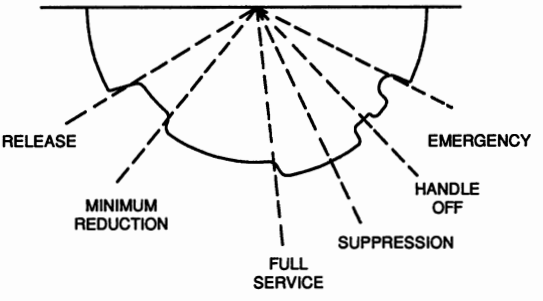
The Automatic Air Brake System operates in response to brake application and release signals of the pneumatic components. This system has a provision for emergency brake application in cases of malfunction.

Operation of the Automatic Brake System is controlled by the Engineman through the Automatic Air Brake Valve (Figure 4-4) which is self-lapping. The Automatic Air Brake Valve handle is positioned to:

a. control air flow into the equalizing reservoir and brake pipe for charging and releasing a brake application.
b. reduce equalizing reservoir and brake pipe pressure at a service or emergency rate to apply brakes.

Starting at the left of the quadrant and moving the Automatic Air Brake Valve handle to the right, the following six (6) operating positions can be initiated:

1. RELEASE - allows charging of brake and equalizing reservoir, releasing the brakes.
2. MINIMUM REDUCTION - provides a brake pipe reduction of approximately 6 to 8 psig.
3. FULL SERVICE or SERVICE ZONE - provides regulation of brake application, increasing braking force as the handle is moved to the right (counter-clockwise). Every 1 lb. reduction of brake pipe pressure results in a 2-1/2 lb. increase in brake cylinder pressure. Example: 10 lb. brake pipe reduction equals 25 lb. brake cylinder pressure application.
4. SUPPRESSION - allows avoidance of an emergency brake application by way of the deadman foot pedal. It allows the engineman to remove foot from the deadman pedal while the master controller is in the Safety Control/Emergency position.



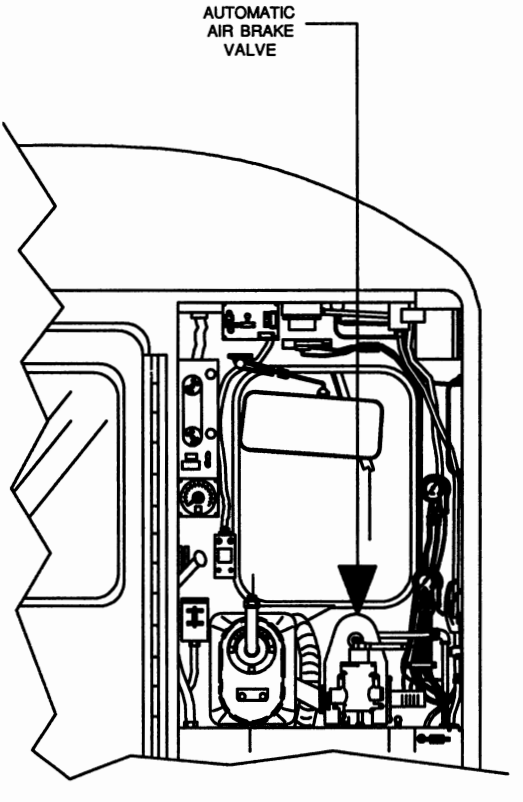


Figure 4-4: Automatic Air Brake Valve
Engineman's Operating Station

5. HANDLE OFF - allows installation and removal of the brake valve handle. To install brake handle, insert handle into brake valve, move to "EMERGENCY" position, push down until click is felt. To remove brake handle, move to EMERGENCY position, pull up until click is felt, move to "HANDLE OFF" position, and remove handle from brake valve. In the "HANDLE OFF" position brake pipe and equalizing reservoir pressure is depleted at a service rate to approximately 10 psig.
6. EMERGENCY - initiates the fastest possible drop in brake pipe pressure to produce an emergency brake application.

Gradually moving the brake handle toward the release position causes a graduated reduction of brake cylinder pressure. This provides a smooth braking of the car.

The Snow Brake Switch (two position toggle switch), located in each operating compartment on the collision door post switch panel (Figure 2-4). When it is cut-in and the brake valve handle is in the RELEASE position, a brake cylinder pressure of approximately 7 psig prevents ice and/or snow buildup between the surfaces of the brake shoes and wheel treads throughout a car/train by keeping brake shoes in contact with the wheels.

NOTE: When snow brake is activated, the automatic slack adjuster will not operate.

NOTE: Snow brake application must be cut-out periodically. If continuously cut-in, wheels will overheat and crack.

When operating stations are changed, the snow brake switch must be cut-out and at least four (4) full service applications and full releases of the brakes must be made before removing the CONTROL Plug and cutting-out the brake valve.

4-2.02 AIR BRAKE COMPONENTS

NOTE: Cars have either number (1) or (2) type of air compressor, below.

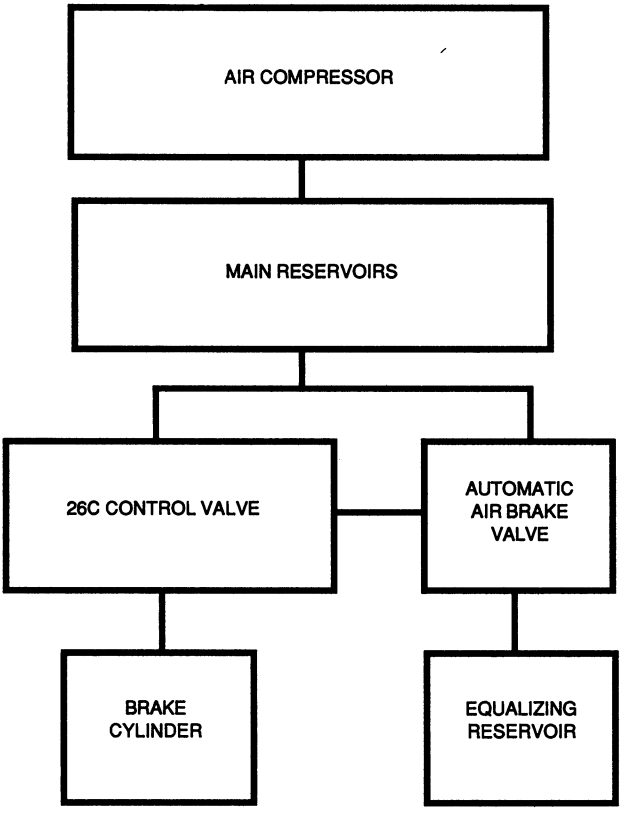


Figure 4-5: Automatic Air Brake System
Functional Block Diagram

1. **D-4 Air Compressor** - WABCO, D-4 motor driven, two piston, V type, two-stage compressor, produces compressed air (at 130-140 psig) to charge the reservoirs.

2. **Rotary Screw Air Compressor** - Model N-9446-2, motor driven, rotary screw type, single-stage compressor, produces compressed air (at 130 - 140 psig) to charge the reservoirs.

3. **Main Reservoir - No. 1** - Stores and cools compressed air from the air compressor; assists in depositing moisture, oil and foreign matter; and feeds clean, dry air to No. 2 main reservoir, the air springs, single car emergency reservoirs, horn, and wiper. No. 1 Main Reservoir is equipped with automatic drain valves and heaters.

4. **Main Reservoir - No. 2** - Stores and cools compressed air from the No. 1 Main Reservoir; assists in depositing moisture, oil and foreign matter; and feeds clean, dry air to the braking system. The No. 2 Main Reservoir is equipped with a drain cock.

5. **Control Reservoir** - Stores air for auxiliary devices, such as: pantograph, electrical propulsion contacts, etc.

6. **Single Car Emergency Reservoirs (2)** - Holds main reservoir air pressure for use in the single car emergency brake system.

7. **Duplex Air Gauges** - Two (2) duplex air gauges, located at the Engineman's operating station, indicate brake pipe (WHITE hand) and brake cylinder (RED hand) pressures on one gauge; main reservoir (RED hand) and equalizing reservoir pressures (WHITE hand) on the other.

8. **Engineman's Automatic Air Brake Valve** - Provides control of brake system devices to apply or release car/train brakes.

9. **Control Valve** - Charges the reservoirs and moves to apply and release brake cylinder pressure in response to the reduction/ increase of brake pipe pressure.

10. **Control Valve Cut-out Cock** - Prevents brake pipe pressure from getting to the control valve, disabling the braking system. If brakes are applied they won't release, if they are released they won't apply.

11. **Engineman's Single Car Emergency Brake Valve(s) (2)** - Initiates a single car emergency brake application.

12. **Conductor's Emergency Brake Valve (2)** - Initiates a trainline EMERGENCY BRAKE application in the coach.

NOTE: Although the Conductor's Valve is intended for Conductor use, it is also accessible to passengers.

13. **Decelostat Valve** - Controls brake cylinder pressure to correct wheel slide. When sliding occurs, braking is reduced until the differential wheel speed is corrected. Brake cylinder pressure is momentarily released on the sliding truck by means of a dump magnet valve and then automatically reapplied.

14. **Leveling Valve** - Provides charging of the air springs and maintenance of car height above the truck, regardless of loading conditions.

15. **Leveling Valve Main Reservoir Cut-Out Cocks (2)** - Provides air to the air spring system from the main reservoir supply during normal operation. It is closed when hauling dead-in-tow.

16. **Leveling Valve Change Over Cocks (2)** - Allows air spring to charge from brake pipe pressure when hauling dead-in-tow.

17. **Truck Brake Cut-Out Cocks (2)** - Closes the air supply to the brake cylinders on a particular truck. Cut-out cocks are vented and will release brake cylinder pressure in treadbrake units on that truck if brakes are applied when cut-out cock is cut-out.

18. **Variable Load Valve** - Regulates brake cylinder pressure during emergency brake applications.

19. **Snow Brake Cut-Out Cock** - Located undercar, non-cab side, right of truck cut-out cock (above and left of 26C service rack). Supplies air to snow brake reducing and magnet valves. Vents the snow brake air line when in cut-out position.

20. **Equalizing Reservoir Pipe** - Situated underfloor. Stores equalizing reservoir pressure which is controlled by brake valve on operating end.

21. **Trainline Brake Pipe Cut-Out Cocks** - Located undercar, non-cab side, right of stepwell. Cuts out brake pipe pressure to N-2-A coupler for trainline. The brake pipe is identified by its 1-1/4" pipe size.

22. **Angle Cocks (2)** - Located at front of car next to coupler. Allows CUT-IN or CUT-OUT of trainline dead-in-tow hose.

23. **Trainline Main Reservoir Cut-Out Cocks** - Located undercar, non-cab side, right of stepwell. Cuts out main reservoir air pressure to N-2-A coupler for trainlining. The main reservoir air pipe is identified by its 1" pipe size.

24. **No. 8 Vent Valve** - Located under carbody. Assists in providing a rapid reduction of brake pipe pressure during emergency applications.

25. **Compressor Governor** - Automatically controls the operation of the air compressor.

26. **Pressure Maintaining Feature** - Maintains brake pipe pressure against maximum permissible leakage when brake valve is lapped after a service brake pipe reduction.

27. **Tread Brake Units (8)** - Mounted directly at each car wheel. Performs the function of brake cylinder -- forced outward by compressed air in applying the brakes; returned by a release spring when releasing the brakes. Also, automatically adjusts brake clearance.

28. **J-1 Relay Valve** - Attached to the variable load valve manifold undercar. Supplies and exhausts air to the tread brake units during brake applications.

4-2.03 Air Spring Suspension System

The suspension system consists of one air spring assembly at each corner of the car (two per truck), a leveling valve at each end of the car (one per truck), and two volume reservoirs per truck.

Leveling valves detect variations in spring height due to changes in passenger load, regulate the flow of pressurized air to/from the springs, and prevent spring deflection into the limit stops under extreme conditions.

When air spring over/under inflation occurs, speed restrictions apply (ref. Section 3-2.05).

NOTE: Failure of the "F" end air spring will cause the load weighing controls to revert to an empty setting, resulting in some reduction of braking performance during emergency brake applications.

Cut-out cocks - Located undercar, on the cab side, between the body bolster and the stepwell at each end of car. Control the source of air to the suspension system (ref. items 14 and 15, Section 4-2.02).

4-3.00 COMMUNICATIONS SYSTEM

Silverliner II cars are equipped with a two-way system that allows communication between trains and train-to-tower operators or dispatchers.

The Communications System's Radio Control Panel, located in the ceiling of each cab to the left of the windshield, consists of a Channel Selector, Volume Control Switch, and Power On Light (Figure 3-3).

A Push-to-Talk Box, to the right of the windshield, is used to transmit and receive messages (ref. Section 3-5.00 for operation).

Hard-wired to the battery and protected by RADIO fuses ("A" END control breaker panel), the communications system is activated when the control plug is inserted into the CONTROL receptacle of a master controller, and deactivated when the control plug is removed.

Reference Section 3-5.02 for reception and transmittal procedures of radio communications.

4-4.00 CAR LIGHTING SYSTEM

4-4.01 EXTERIOR LIGHTING

Silverliner II cars are equipped with two headlights, located on each end of the car. Each headlight consists of a 200 watt, 32 volt sealed beam prefocused lamp, controlled by a three position toggle switch mounted on the collision door post (Figure 2-4).

Switch positions:

1. "BRIGHT" in the up position.
2 "OFF" in the center position.
3. "DIM" in the down position.

Red marker lights located on each end of the car are controlled by a switch in the ceiling of each vestibule above the Engineman's position. Power for the marker lights is supplied from the battery regulated circuit and protected by a circuit breaker in the "A" END control breaker panel.

4-4.02 INTERIOR LIGHTING

The coach light panel, located in the passenger compartment, contains the switches that control interior lighting. The panel consists of three coach ceiling light switches (fluorescent lights), and a low ceiling light switch (incandescent lights).

The fluorescent lighting arrangement on the panel is divided electrically into three circuits which illuminate the full length of the car body. Each fluorescent lighting circuit is controlled by a separate circuit breaker in the control breaker panel, and a separate switch on the "A" END of the passenger compartment.

Incandescent lights (low ceiling fixtures) are energized from the 110 volt, 48 cycle outlet-transformer, which also furnishes power to service receptacles in the car body.

Incandescent emergency lights are located in the ceiling fluorescent fixtures, and two (2) low ceiling lighting fixtures. In the event that the fluorescent light power source should fail, the emergency lights will automatically connect to regulated power from the storage battery.

4-4.03 FAULT INDICATING LIGHTS

There is one (1) panel indicating light located in the operators control cab at each end of the car, the fault indicating light. This is located on the switch panel to the left of the Master Controller above the headlight switch, and illuminates when a ground (short circuit) to the car body occurs on both the primary and secondary side of the transformers, upon excessive temperature rise of the main transformer or overload.

Fault light indication is provided when the relay coils of the following devices sense a fault condition:

1. Line Overloads (OLR1, 2, 3) of the Rectifier Group.
2. Motor Overloads (OLRM1 & OLRM2) located in the Main Group.
3. Ground Relay (GR) of the Main Group.
4. Transformer Primary Overload (THR) located in the Main Group.

5. Transformer Hot Cooling Fluid (TRF) in the Main Group.
6. Reduce Power Ground Relay (RGR) located in the Main Group.

All of the devices above, except THR, may be reset by depressing local reset buttons (ref. Section 2-4.01). Inserting the control plug into the RESET receptacle will reset GR and Overload relays only (ref. Section 2-2.01).

4-5.00 TEMPERATURE CONTROL SYSTEM

4-5.01 HEATING, VENTILATING, AND AIR CONDITIONING (PASSENGER COMPARTMENT)

Various equipment groups and controls make up the Silverliner II Heating, Ventilating, and Air Conditioning (HVAC) system. They automatically maintain interior air temperatures and provide layover heat to preset values. The HVAC system on each car operates independently and simultaneously when placed "IN SERVICE" or during layover.

Controls respond to recirculated inside and outside air temperatures to selectively energize various equipment groups for the following three modes of operation:

1. Ventilation only, no heating or cooling functions when the car interior temperature is between 68°F and 71°F.
2. Ventilation and cooling.
3. Ventilation and heating.

Outside and recirculated inside air is drawn into each air conditioning (A/C) unit and mixed. The air stream is then conditioned per thermostatic demands and forced by blower fans into the main overhead supply duct.

When cooling is called for, the controls initiate compressor and condenser operation, activating the refrigeration cycle of each A/C unit, and regulating the two stages of cooling capacity (Full or Partial).

When heating is called for, the controls selectively operate overhead heating units (in the mixed air stream) and a floor heating system.

4-5.02 CAB HEATER AND DEFROSTER

Located under the windshield in each cab, it provides "on-demand" heat and windshield defrosting. It is activated by a manual control switch (located on the collision door post switch panel), which allows selection of blower only or heater and blower operation. It is operable only if the engineman's control plug is inserted in that cab's master controller CONTROL receptacle.

4-5.03 LAYOVER HEATING SYSTEM

A layover heat control circuit provides a means of maintaining a 50°F layover temperature when the cars are not in use. Only 2/3 of the total available floor heat is used for heating during the layover period. The layover circuit is activated automatically when the control plug is removed from the master controller and the Air Conditioning and Heat circuit breaker is in the ON position.

4-5.04 PROTECTIVE HEATING SYSTEM

Protective heat for brake system components on each car is initiated by a control thermostat automatically (when outside temperature is below 40°F), to prevent components from freeze-up.

When required, the battery source is used to activate the heater for No. 1 Main Reservoir Automatic Drain Valve and Filter Dryer freeze protection.

SILVERLINER II - OPERATOR MANUAL

SECTION 5
TROUBLESHOOTING

5-1.00 TROUBLESHOOTING PROCEDURES

Troubleshooting procedures described in this section suggest actions which may be taken to correct equipment malfunctions encountered in service to allow the car/train to continue operation. "Corrective Actions" listed in the Troubleshooting Tables address the procedures that may be used in route. SEPTA regulations must be followed when resetting equipment or continuing car/train operation with disabled equipment function.

GENERAL

1. Cars contain outside electrical panel boxes. Relays and switches in each box are listed by their schematic symbols, used on equipment drawings. For the purposes of this manual, the following electrical relay and switch abbreviations are used:

AUXILIARY CONTROL GROUP

PPB - Transformer Coolant Pump Breaker
CHB - Cab Heater Breaker
FHB - Floor Heat Breaker
OHB - Overhead Heat Breaker
MRDR - Main Reservoir Auto Drain Heater
MAB - Motor Alternator Breaker
BMAB - Blower Motor Alternator Breaker
ACAB - Motor Alternator (Output)
ACB - Air Compressor Breaker
FLB - Fluorescent Light Breaker
RTB - Rectifier Transformer Breaker
OTB - Outlet Transformer Breaker
AC-1 - Air Compressor Contactor Reset
BMB - Blower Motor Breaker
RB - Rectifier Breaker
MCB - Master Controller Breaker

MAIN CONTROL GROUP

RGR - Reduced Power Ground Relay
GR - Ground Relay
OL - Overload Reset
TRF - Hot Transformer Cooling Fluid Relay
PLR - Pantograph Lowering Relay
THR - Transformer Hot Relay
SPLR - Slip Pinion Relay (Not Used)

2. Circuit breakers that trip halfway must be pushed all the way down to "OFF" position and then placed in the raised "ON" position.

3. Electrical relays when tripped are reset either by a "push in" type button or mechanical switch with a "red" tripped marker line. Push the button or switch to reset.

5-2.00 ELECTRICAL DIFFICULTIES

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
1. The train will not take power, catenary is energized.	a. Control plug is not fully inserted in CONTROL receptacle.	Check to see that control plug is fully inserted in CONTROL receptacle.
	b. Trainline circuit breaker tripped.	Set trainline circuit breaker ("A"END control breaker panel) "ON".
	c. Coupler door cover (rear coupler of rear car) not closed.	Ensure that coupler door cover is completely closed. If necessary, dog coupler.
2. No power on one car.	a. Control cutout breaker "OFF".	Set control cut-out breaker ("A" END control breaker panel) "ON".
	b. Auxiliary group circuit breakers tripped.	Set all circuit breakers in auxiliary group "ON".
	c. Overload relays tripped.	Insert control plug into RESET receptacle.
	d. GR and RGR tripped.	Insert control plug into RESET receptacle and manually reset RGR.
	e. Motor cut-out switches "OFF".	Set motor cut-out switches ("A" END control breaker panel) "ON".

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	f. Dogged coupler heads.	Check to see that coupler heads are not dogged.
3. Air Conditioning or heating inoperative.	a. Control plug not fully in CONTROL receptacle.	Insert control plug in CONTROL receptable
	b. A/C heat switches "OFF".	Set all A/C heat Switches ("A" END control breaker panel) "ON".
	c. Auxiliary circuit breakers Air Cond./ Heat, OHB1 & 2, FHB1 & 2, CHB1, BFB1 & 2, FCB1 & 2 tripped.	Set all circuit breakers in auxiliary group "ON".
4. Fault indicating light is illuminated.	a. Ground fault, overload, or TRF fault.	Insert control plug into RESET receptacle to reset overload relays and ground fault relay. If the fault indicating light does not extinguish, manually reset "RGR" or "TRF" in Main Group.
5. Pantograph lowers, catenary is engergized.	a. Local Pantograph switch in "DOWN" position.	Set "Local Pantograph" switch ("A" END control breaker panel) to "UP" (train-lined) position.
	b. PLR relay tripped.	Radio train dispatcher or car shop for permission to reset "PLR" relay.
6. Pantograph lowers, catenary is de-energized.	a. THR relay tripped.	Check "THR" relay. If tripped, perform a walk-around inspection of the car to look for signs of fire, smoke, or the odor of burned insulation. **DO NOT** reset any relays on the car. Notify train dispatcher or car shop.

5-3.00 BRAKE DIFFICULTIES

The following are Air Brake troubleshooting procedures for Silverliner II cars:

NOTE: SEPTA regulations must be followed when resetting equipment or continuing train movement with disabled equipment function.

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
1. Air compressor stops.	a. Air compressor governor cut-out breaker "OFF".	Set air compressor governor cut-out breaker ("A" END control breaker panel) "ON".
	b. "AC1" relay tripped and "ACB" breaker "OFF".	Reset "AC1" relay and set "ACB" breaker "ON".
	c. ACAB breaker tripped	Reset ACAB breaker "ON".
2. Brakes fail to release on one car.	a. Hand brakes "ON".	Check handbrakes.
	b. Brake pipe and main reservoir cocks not properly opened.	Check coupler between affected and non-affected cars. Ensure that brake pipe and main reservoir cocks are properly opened.
	c. Snow brake air cock stuck or defective.	Cut-out snow brake air cock.
3. Brakes fail to release on entire train.	a. Hand brakes "ON".	Check hand brakes.
	b. Emergency valve "opened".	Close any "opened" emergency valve in train.
	c. Brake valve cut-in at a non-operating control stand.	Cut-out brake valve.
	d. Air leak at couplers.	Check for air leak at couplers. If found defective, cut-out brake pipe feed to coupler, couple brake pipe tow hose and open angle cocks.

SILVERLINER II - OPERATOR MANUAL

SECTION 6
MISCELLANEOUS EQUIPMENT AND PROCEDURES

6-1.00 SAFETY EQUIPMENT AND ACCESSORIES

6-1.01 FIRE EXTINGUISHER

A Chemical type "B" and "C" Fire Extinguisher is located on each Silverliner II car inside the "A" END vestibule (Figure 1-1).

WARNING:

OPERATING PERSONNEL MUST FOLLOW FIRE EXTINGUISHER NAMEPLATE INSTRUCTIONS.

6-1.02 EMERGENCY LIGHTS

Incandescent emergency lights are located in the ceiling fluorescent fixtures and two (2) low ceiling lighting fixtures. In the event that the fluorescent light power source should fail, the emergency lights will automatically connect to 32 volt regulated power from the storage battery.

6-1.03 HANDBRAKE

Located in the "B" END Operator's cab (Figure 6-1). Braking force, produced by rotating the handwheel clockwise, is exerted on two (2) tread brake shoes of the "B" END truck.

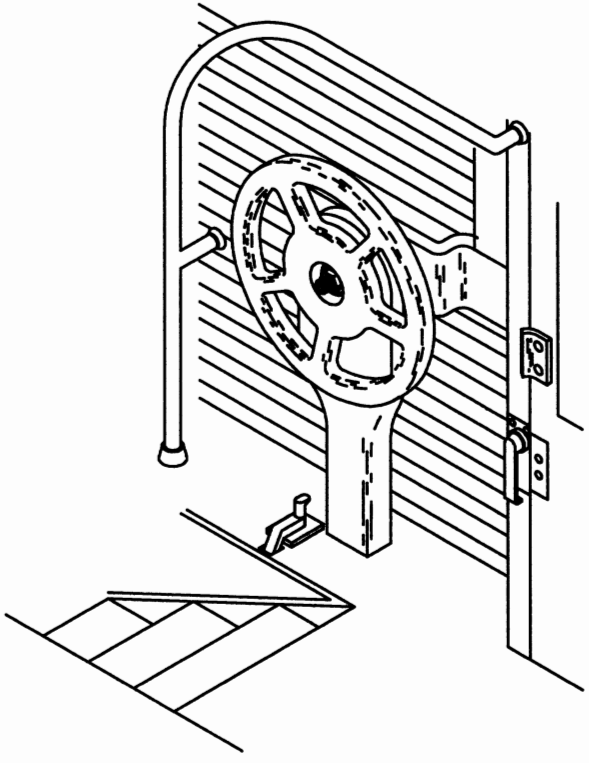


Figure 6-1: Handbrake Operating Cab, "B" END

6-1.04 MANUAL UNCOUPLING WRENCH

The Manual Uncoupling Wrench (Figure 6-2) is located at the "A" END, under the car and is used in the event of loss of air or failure of the unlatching piston to move when an uncoupling valve is operated. It functions to enable the cars to be separated by manually unlatching the couplers of both cars. The uncoupling wrench is 60 inches in length (permitting access to the latch screw without stepping between the cars) and has a nonconductive shaft between a standard socket and the crosshandle insulating the device for safe use.

Procedure for using the manual uncoupling wrench follows:

From the side of the car, apply the manual uncoupling wrench to the uncoupling bolt (located on the outboard face of the coupler latch cover) and turn it counterclockwise while the couplers are in buff.

NOTE: Uncoupling is not to be attempted with couplers stretched.

The uncoupling bolt is designed so that it will not completely unscrew from the cover.

NOTE: The manual uncoupling bolt on <u>both</u> couplers must be unscrewed to uncouple cars.

NOTE: Return manual uncoupling bolt to "screwed-in" position after manual uncoupling is accomplished.

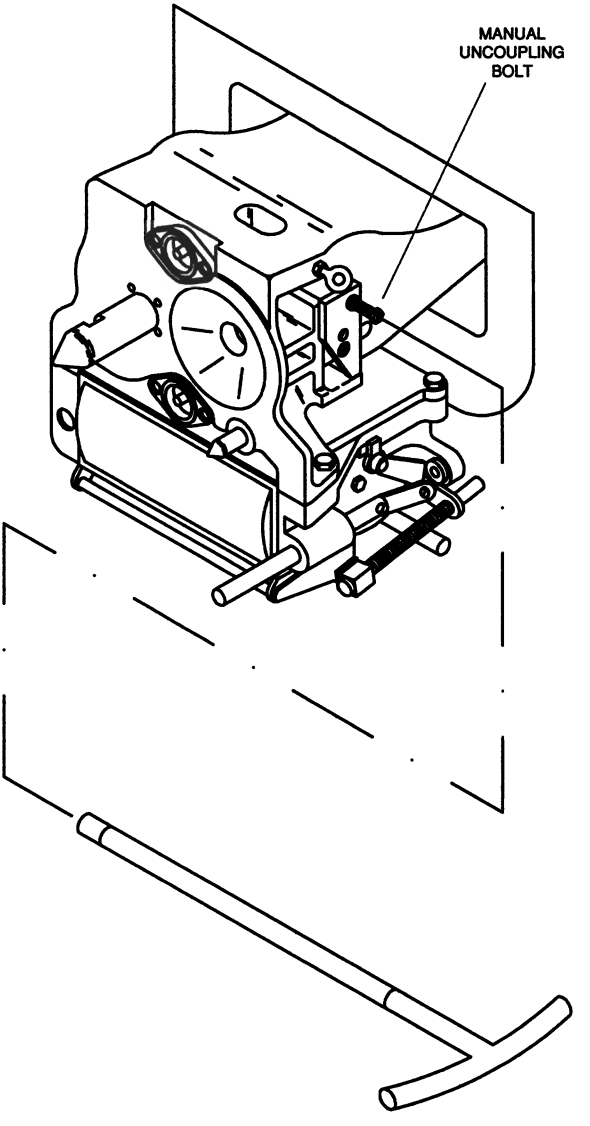


Figure 6-2: Manual Uncoupling Wrench

6-1.05 PANTOGRAPH HAND PUMP

The Pantograph Hand Pump (Figure 6-3), located under-car between the cab signal box and temperature control box (Figures 1-4 & 1-6), is used to manually release the pantograph latch, allowing the pantograph to raise. The pump is single acting, hand-operated.

A 3-way valve is located between the manual hand pump and the pantograph magnet valve assembly. It controls which device activates the pantograph latch cylinder.

The following explains the use of the 3-way valve:

1. Automatic or Magnet Valve Position - handle pointed away from pump.
2. Place handle so it is pointed toward pump.
3. Pump pantograph up.
4. Return handle to Automatic position, pointing away from pump.

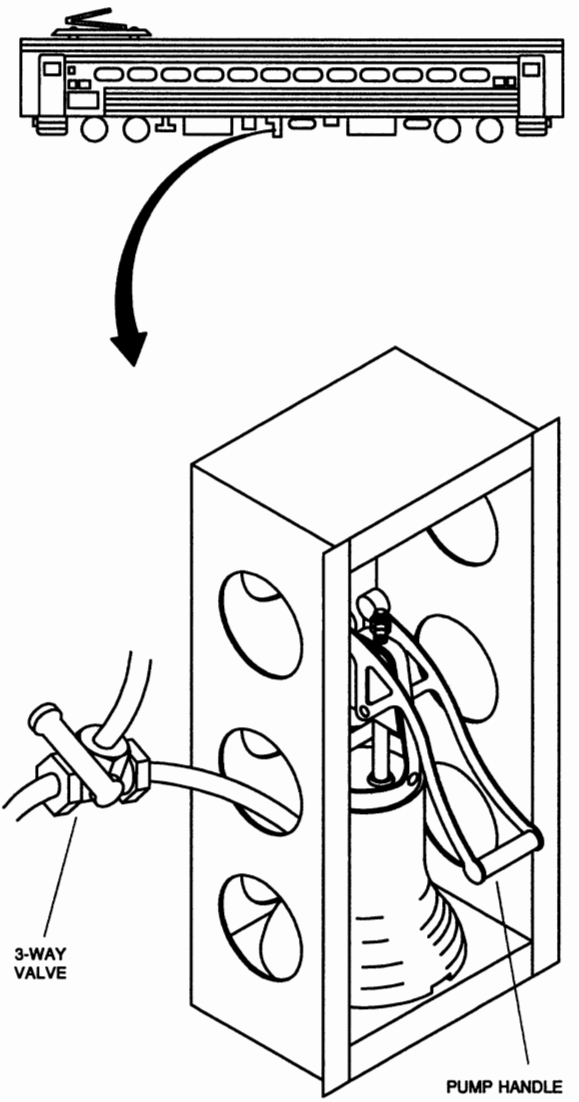


Figure 6-3: Pantograph Hand Pump

6-1.06 PANTOGRAPH UNLATCHING POLE

The pantograph unlatching pole is stored in a tube outside the cars below the side sill, on the ODD Side of the car, and above the transformer high tension lead (Figure 1-6). When the pantograph is lowered and latched, the pole is used to release the pantograph latching mechanism; the pantograph will automatically raise when the latching mechanism is disengaged.

WARNING:

OPERATING EMPLOYEES NOT PERMITTED ON ROOF AND MUST HAVE PERMISSION FROM PROPER AUTHORITY TO OPERATE GROUNDING SWITCH.

6-1.07 PANTOGRAPH GROUNDING SWITCH

The pantograph lockdown switch is a hand-operated lever system which locks down and electrically grounds the pantograph (Figure 6-4). When the pantograph is unlocked, the handle of the lockdown switch blocks the ladder preventing access to the roof of the car. To access roof, the handle must be moved, causing the lockdown switch to close, lock, and ground the pantograph. **DO NOT ATTEMPT THIS PROCEDURE WITH PANTOGRAPH IN RAISED POSITION.**

6-1.08 EMERGENCY BRAKE VALVES

Each Silverliner II car is equipped with two (2) emergency brake valves located within the passenger area in the ceiling at each vestibule door (Figure 2-7). When activated, these valves will affect an emergency brake application throughout a train. Although intended for conductor use, they are accessible to passengers.

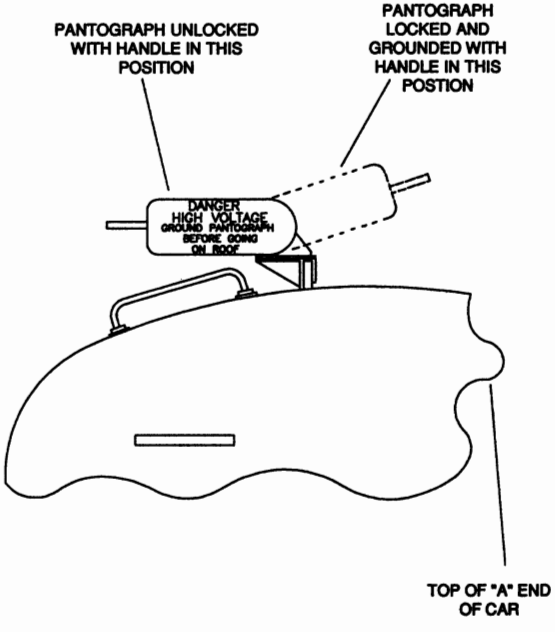


Figure 6-4: Grounding Switch

6-1.09 EMERGENCY ESCAPE WINDOWS

Emergency exit windows may be used in the event of an emergency where evacuation of the car is necessary but exit through door is not possible. Refer to Figure 1-5, Car General Arrangement Illustration.

WARNING:

WHEN EXITING FROM TRAIN THROUGH THE EMERGENCY EXIT WINDOWS AT OTHER THAN HIGH PLATFORM, BE AWARE THAT THERE MAY BE A 6 TO 8 FOOT DROP TO THE ROADBED.

To remove the emergency windows:

1. Pull the red handle on the rubber filler strip out and remove the entire filler strip from around the window.
2. Pull the second handle, bolted to the window, to remove the window from the rubber glazing strip.
3. Turn and push the window through the opening. The car may be exited through the opening.

6-2.00 COUPLING TO A LOCOMOTIVE

6-2.01 COUPLER ADAPTER FOR TOW

The coupler adapter, located on the "B" car end only (outside stairwell bracket), connects a car equipped with a knuckle coupler to Silverliner II cars equipped with N-2-A couplers for towing purposes (Figure 6-5).

The coupler adapter design consists of two outer steel plates welded to steel spacers. The steel plates are contoured on one end to mount to a knuckle coupler, while the other end contains a coupling spear to mount to the N-2-A coupler. A latch (attached to the coupler by a chain) is inserted into the adapter after coupling of the cars. The latch works as a wedge between the adapter and slot in the coupling spear.

WARNING:

MAKE SURE THAT CAR IS PROPERLY SECURED BEFORE APPLYING COUPLER ADAPTER TO PREVENT MOVEMENT OF CAR.

6-2.02 AIR SYSTEM SET UP FOR DEAD-IN-TOW

The Angle Cock and Tow Hose, located at each end of a car (end of brake pipe line), are used to make car-to-locomotive connections.

Below are procedures for connection:

1. Join Brake Pipe (BP) trainline and tow hoses together.

2. Set the following valve positions for tow:

VALVE	LOCATION	POSITION
1. Angle Cocks	End of brake pipe line at coupled end of car	Open
2. Main Reservoir Line Cut-Out Cock	Undercar, non-cab side next to step well (1" pipe)	Open
3. Brake Pipe Feed Cut-Out Cock	Undercar, non-cab side next to stepwell (1-1/4" pipe)	Open
4. Leveling Valve Supply Cut-Out Cock from Main Reservoir Line	Undercar, cab side between body bolster and stepwell, each end	Closed
5. Leveling Valve Supply Cut-Out Cock from Brake Pipe	Under car, cab side between body bolster and stepwell, each end	Open

NOTE: AIR SYSTEM MUST BE FULLY CHARGED BEFORE MOVING UNIT.

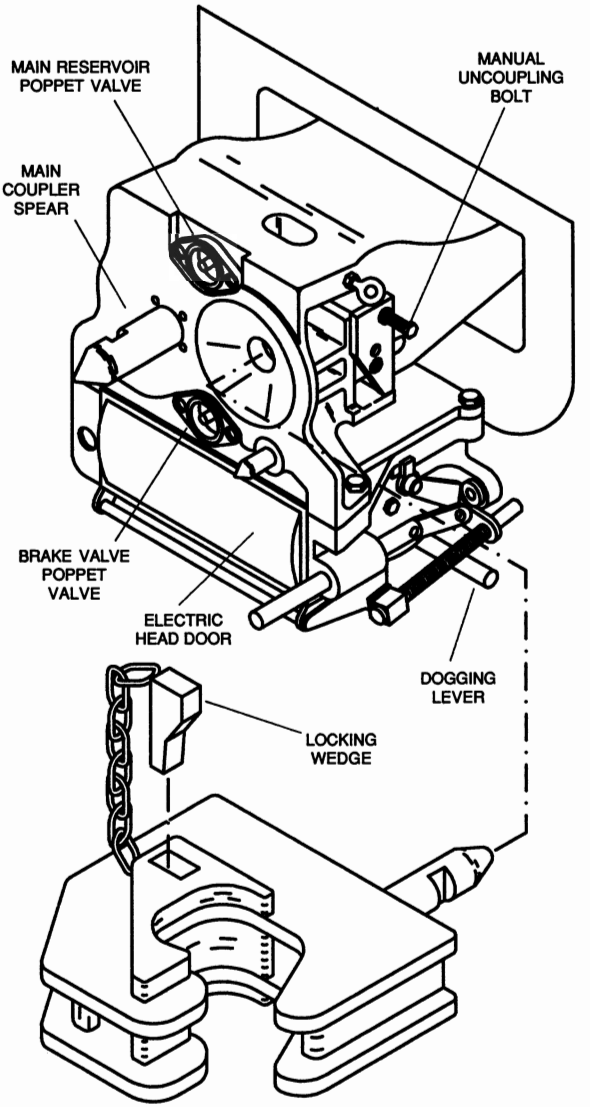


Figure 6-5: Coupler Adapter